Volume 12, No. 6 November, 1957

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Aspects of Land and Water Use in the Forest Preserve District of Cook County, Illinois

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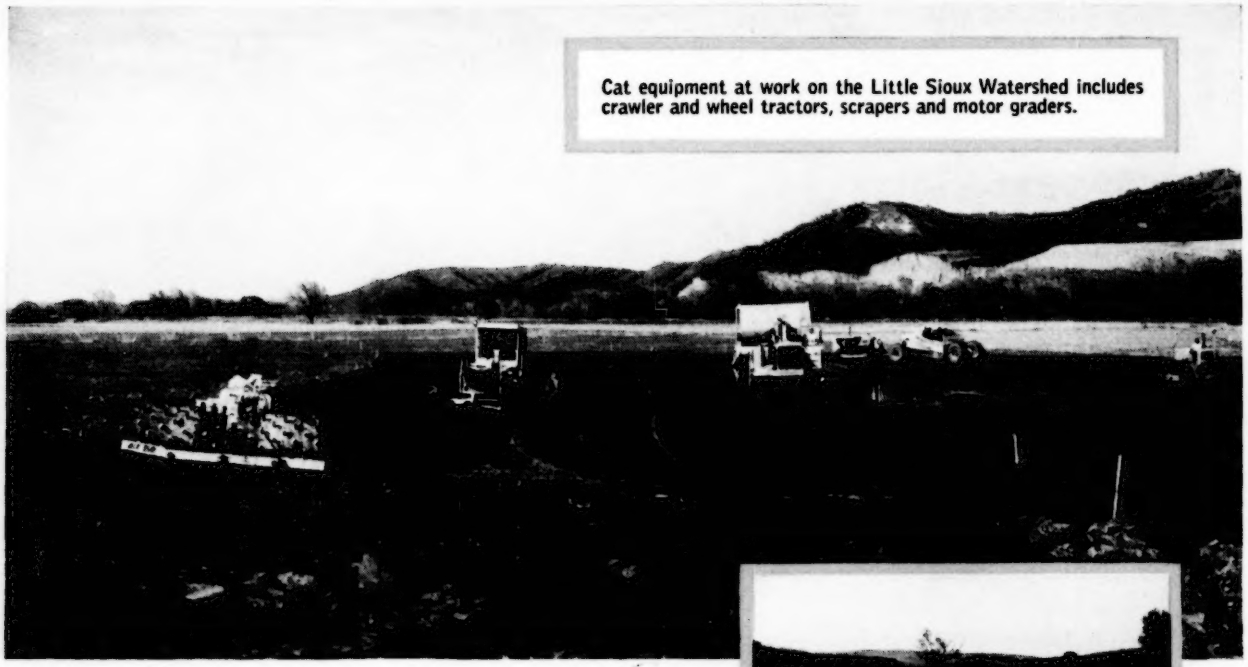

Cat equipment at work on the Little Sioux Watershed includes crawler and wheel tractors, scrapers and motor graders.

Civilizing the Little Sioux

The wide Missouri and its vast system of tributaries roll along peacefully – most of the time. But every spring they turn into muddy monsters threatening the downstream cities of Omaha, Kansas City and many others. You've seen the toll they take in terms of human lives and livestock, ruined farm homes and industries and loss of irreplaceable soil.

Some day all this will be history. Work on one small, but important, tributary of the Missouri is setting the pattern for future conservation. This is the Little Sioux Watershed, south of Sioux City, Iowa.

This project includes moving vast yardages of earth for dams, terraces, diversion ditches, clearing land, straightening creeks, etc. It is a joint effort of farmers, businessmen, governmental agencies. It is on a cost sharing basis with both local associations and government grants supplying the needed capital. Big yellow CAT* Diesel Tractors and equipment are at work on the big structures, while upstream farmers and conservation contractors build terraces, ponds and grassed waterways to control the water as it falls.

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PROBLEM: badly eroded farm land made useless for farming in the Little Sioux Watershed.

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Journal of SOIL AND WATER CONSERVATION

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TO ADVANCE THE SCIENCE AND ART OF GOOD LAND USE

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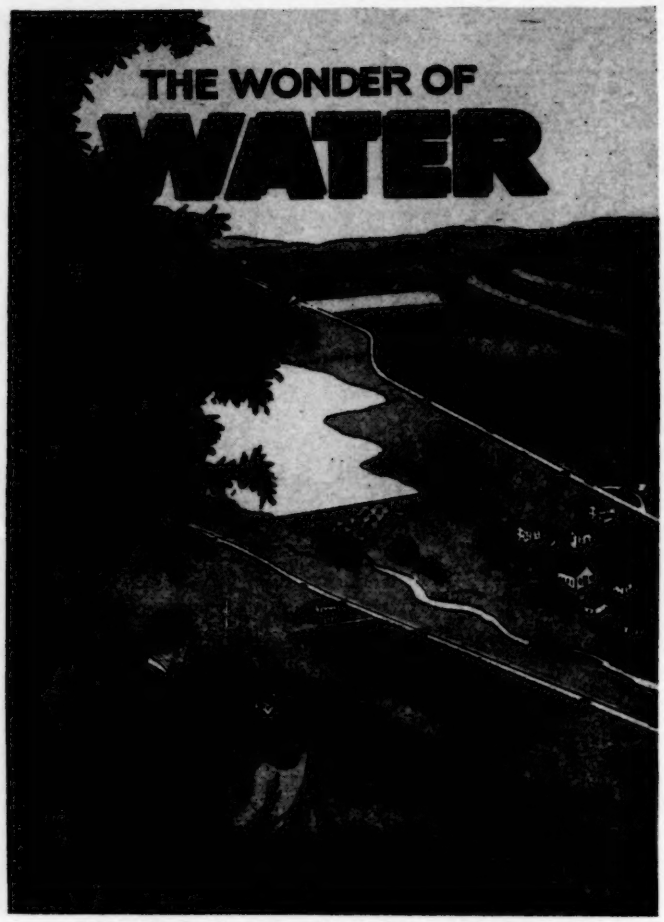

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Water, The Nation's Concern Today— A Problem Tomorrow

R. G. GUSTAVSON

"Water has always had a very unique place in the culture and indeed in the religions of all peoples. It was regarded as one of the fundamental elements by the Greeks. Even as late as the beginning of the 17th Century it was regarded by many scientists as the basic substance out of which all matter was made. One of the very earliest experiments of the scientific era was designed to test this theory. It is an experiment worth recalling periodically because it has some very basic contributions to make in connection with solving water problems of today."—R.G.G.

JEAN VAN HELMONT was a contemporary of Galileo, the father of modern physics. He was a distinguished Belgian chemist. He offered the following experimental proof for believing that water was the fundamental element in all matter. He took a number of plants and dried some of them very carefully, then heated them in the absence of air and weighed the charcoal which remained. The remaining plants were carefully planted in a weighed amount of dried earth and watered periodically. After a number of months had gone by and the plants had grown large in size, he removed the plants from the soil in which they were planted, dried the soil again and weighed it very carefully, and found that the loss in weight was very small. The plants were then dried, heated in the absence of air, and the amount of charcoal weighed. The amount of charcoal had increased tremendously. All that had been added was water. The conclusion was inevitable. Charcoal comes from water. Now this experiment can be repeated today and the results will be exactly those obtained by van Helmont. The error, of course, is that van Helmont did not know that the atmosphere contains approximately eight parts of carbon in the form of carbon dioxide in every 100,000 parts of air, and it is this very, very small amount of carbon which is the source of the charcoal in his experiments. The experiment carries an object lesson with it, namely, our success in finding truth depends upon knowing all the factors involved in any given problem.

R. G. Gustavson is President and Executive Director of Resources for the Future, Inc., Washington, D. C. Water, The Nation's Concern Today —A Problem Tomorrow was very favorably received at the Twelfth Annual Meeting of the Soil Conservation Society of America, Pacific Grove, California, August 29, 1957.

Water Essential

From another point of view, it is true that water is essential to the production of practically all material things. Dr. Edward Ackerman has stated this very beautifully.*

"Where there is life there must be water. There is no organism today, plant or animal, which is not highly dependent on it. This is true even for those forms of desert life, like the kangaroo rat, which live for long periods without visible water intake. A seed will not sprout without water. Water has a basic role in the formation of the protein molecule, the fundamental material for all living matter, plant and animal. No less than light it is essential to photosynthesis, the biochemical process by which food crops and all other plants obtain the principal raw materials for their growth. For every pound of dry stalk, leaf or seed produced by any plant, from 300 to 1,000 pounds of water must be absorbed and discharged, or transpired, by the plant.

"Apart from fat, the tissues of all animal bodies are 70 to 90 per cent water, including those of our own bodies (about 71 per cent water). Water's great importance to existence itself for the higher forms of life is shown by loss tolerances. An animal can lose nearly all its fat, and one-half the protein, from its normal body and still live. If it loses a tenth of its water it will die.

"The rain and snow which fall on United States territory must serve the consumptive life needs of every tree, crop, animal and human being living here. But the runoff and infiltered waters have uses far beyond the food and sustenance which all living things require. In many ways it is at the heart of our industry, commerce and other aspects of our organized economic life.

*Resources for the Future lecture before Department of Agriculture Graduate School, February, 1957, Washington, D. C.

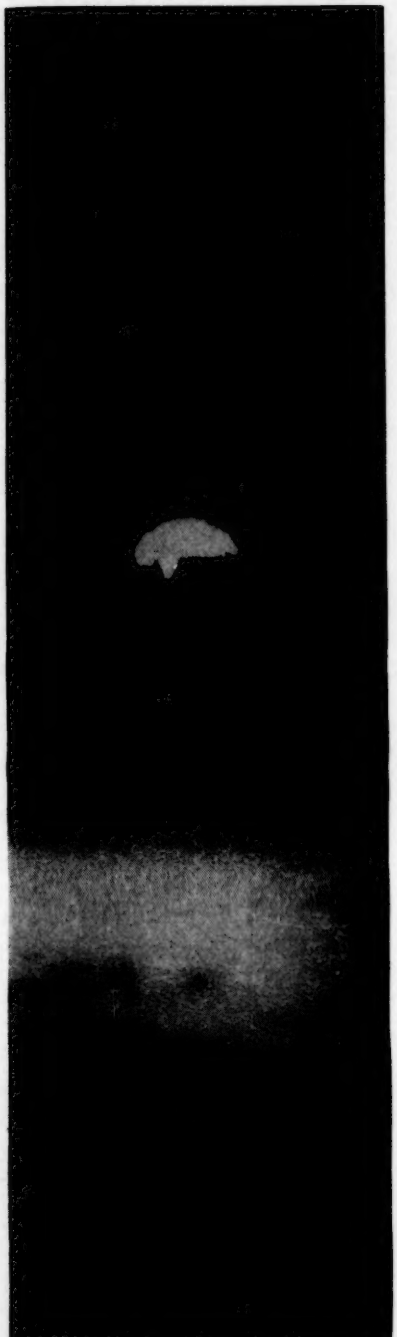
"Water is by far our major industrial solvent. Consider the extent of its laundry uses alone in this respect. It is an essential waste carrier everywhere, and the most widely used means of fire control. Water also is one of the most widely enjoyed media for outdoor recreation. It is essential to the production of nearly every kilowatt hour of electricity which lights our rooms, heats the electric range, turns the washing machine or powers the television set. It offers the cheapest medium for heavy transportation. Few common industrial products are manufactured without the expenditure of water which weighs many times the finished material itself. It is used in our factories as a coolant, solvent, flotation medium, energy transfer agent, diluent and in other ways.

"To make the paper in a five-pound Sunday newspaper 1,250 pounds (150 gallons) of water were used. The ton of steel in the average automobile required 285 tons of water in its conversion from iron ore. Each gallon of gasoline consumed as the auto moves along the road represents the previous use of about 25 gallons of water in its manufacture.

"One may go on with a long list of familiar modern commodities, all of which require the use of a great deal of water. The chemical industry, in particular, is a heavy water consumer. This is illustrated by the manufacture of rayon. The five pounds of fiber found in a man's summer suit required the use of about 11,000 pounds of water in their creation. In short, our industry, like life itself, would not exist without water. Water is the most used material moving through our factories."

Increased Population Demands

The population of the United States is increasing at a rate of more than two million every year. Our rate of increase is one of the highest in the world because scientific medicine has given us a very low infant mortality. Scientific agriculture and technology have provided an adequate diet for our people. Life has been lengthened. This has put a heavy drain on resources—soil, water, timber, minerals and wildlife. The water problems brought about by a growing population have been accentuated by an accelerating rate of water use. Since 1900 the rate of water use has increased about twice as fast as the population. In the time that the population has doubled, annual water consumption has quadrupled. The United States Geological Survey reported that in 1953 about one-third of the 200 cities in the country above 50,000 population were suffering in some degree from inadequate water supplies. One-fourth of all the people served by public water supplies had their service curtailed in the summer of 1953.



SPUTNIK?

No, it's a "little old" raindrop stopped by photography. ***(S.C.S. photo)***

WATERDROPS multiplied are a basic ingredient of all life . . . and all earthly processes . . .

It's no wonder that human beings should be concerned. ***(Des Moines Register & Tribune photo)***

Small wonder then that we have made a gigantic effort to conserve and increase our supply of water. These efforts have at times been carefully thought out. At times our efforts have had little scientific foundation. The problems are complicated by unknown factors, multiplicity of factors and, to no small extent, guided by prejudice.

Problems of this kind are always difficult to solve. The physical scientist has the advantage that in most of his problems the possibility of an unknown factor being present is usually small. The number of factors is also limited and he has ways and means of eliminating personal prejudice. But most of the problems that we face in society are not handled that easily. This is especially true of our social problems. It happens to be true in the problem of rainmaking.

Rainmaking

Since only a relatively small percentage of the water in the atmosphere remains on the land, it is not strange that man has made some very sizable efforts to increase the precipitation from clouds, especially during periods of drouth. The Cloud Physics Research Group at the University of Chicago stated recently:

"More than six times as much water flows across continental United States in the air as is carried by all the country's great rivers. About 99 per cent of this atmospheric water flows in the invisible vapor form ready to condense on our glasses of ice water or to form as fog or cloud in any other cooled place.

"Water in the air is a resource which can be tapped only subject to the caprices of nature. Too much rain falls in some places, and not enough falls in others. Most discouraging is the variation with time in a given area; for example, the floods in Kansas in 1951 and the severe drouths of succeeding years in the same area.

"The enthusiasm with which discoveries of rainmaking possibilities have been received may lead the casual observer to say that weather control is an established fact that needs only proper application. Most meteorologists would say that there is only limited usefulness of present techniques and would take a cautious but optimistic stand. There is a vocal minority of meteorologists and other scientists who are satisfied that large-scale production of striking increases in rainfall has been proved and who are impatient with those who ask for better proof. At the other extreme there may be a few who would say that rainmaking is not worth trying.

"The area of disagreement is made up of (1) doubts as to statistical design and interpretation of tests and (2) doubts about the physics of natural and artificial precipitation."

Clouds are usually made up of very tiny droplets of water. The distance between droplets is great compared to the diameter of the droplets. The average size of these droplets is one-thousandth of an inch. Raindrops which we are familiar with are much larger. It takes from one to eight million of these tiny droplets to make a single raindrop that will fall to the earth. This is the heart of the problem of rainmaking. How is it possible for nature to bring together so vast a number of droplets to form a single drop of rain?

It has been shown in laboratory experiments and in natural clouds that under certain conditions, through proper cloud-seeding techniques, it is possible to form the raindrop from the tiny droplets just described. What are the conditions and what are the techniques?

The conditions include certain temperature ranges, dew-point temperatures, liquid water content and droplet sizes. It is possible to determine by techniques that have been developed if a given cloud provides the proper conditions. These measurements can be made quickly while in airplanes flying through the cloud. The seeding techniques are familiar to most of you. All of them attempt to distribute nuclei in the cloud around which condensation can take place; they include "dry ice," silver iodide, sprays of water itself, ordinary salt and even different kinds of dust.

The University of Chicago group under the leadership of Professor Horace Byers has actually equipped an airplane with the facilities for making these measurements and flown through clouds. On the basis of the information obtained, scientists in the nose of the plane decide whether the cloud should be seeded or not in an attempt to produce rain. If a decision is in the affirmative, the workers in the rear of the plane are so notified. But this does not mean that the cloud will be seeded. Random numbers are then selected and on the basis of these numbers the cloud may or may not be seeded, but the workers in the front of the plane never know until later whether this was or was not done. Radar is then used to determine whether precipitation took place. In this way the statistician gets the kind of information which comes from what is called "random sampling" and this is the kind of information which, if he has it in sufficient quantities, enables him to make a decision as to whether the cloud seeding process produced any rain over and above what would have taken place by natural processes had the clouds not been seeded.

Waters of the Underground

The exploitation of underground waters has served to satisfy somewhat the ever-increasing demand for water. In the state of Nebraska, 90 per cent of the water used for irrigation comes from this source. On the basis of 1949 data, it has been estimated that 91 per cent of all installations for water withdrawal of any kind in the United States were for the withdrawal of ground water.

About 25 per cent of the irrigated acreage of the country is served by ground water and about 23 per cent of all water used for irrigation in 1950 was from ground water.

There are many problems connected with the study of our underground waters, such as: how much do we have in any given locality; what are the rates of recharge; rates of discharge; and rates of movement of underground waters.

I should like now to call your attention to some recent discoveries in pure science which may have a very important bearing on our knowledge concerning underground water supply.

For the last quarter of the century we have been aware of the fact that our atmosphere is being bombarded with high energy particles of varying sizes from outer space. Among the results of the bombardment is the production of a radioactive form of hydrogen called tritium. In the days when most of you studied chemistry, water was regarded as a simple substance having the formula of H_2O, with only one kind of hydrogen atom and only one kind of oxygen atom. This we know no longer to be true. We now recognize three different kinds of hydrogen atoms, one having a weight of 1 on a certain scale, which is ordinary common hydrogen, a second variety having a weight of 2 which we call deuterium. This is frequently called "heavy hydrogen." There is a third form which is called tritium which has a weight of 3. Tritium is the radioactive form of hydrogen and 12½ years are required for half of any given amount of tritium to disappear, by being converted into helium.

Tritium combines with oxygen to form a kind of water in which ordinary atoms of hydrogen have been replaced by radioactive tritium. The tritium water comes to the earth as rain. The formation of tritium in the upper atmosphere is apparently quite constant. Once separated from the upper atmosphere, however, it begins to disappear, half of it disintegrating every 12½ years. Tritium water has all of the properties of ordinary water with one exception, namely its radioactivity. It finds its way into the ground water. It finds its way into living things just as ordinary water does. In fact, it is very difficult to separate it from ordinary water.

It is now possible to determine the age of wines kept in storage from their tritium content and these figures have been confirmed by records. The liquor merchant must now be careful to tell the truth about the age of his wares.

Are We Mining Water?

The determination of tritium in water is carried out by a very sensitive method of analysis, the kind of analysis that is made possible by modern studies in radioactivity and the detection of radiations. It is reported in terms of atoms of tritium per 10^{18} of molecules of water. An

WATER FLOWING from this deep well probably fell as rain 50 years ago. In this sense are we mining water? ***(S.C.S. photo)***

example will make clear how this information can be used in connection with our study of ground waters. A sample of water taken from a well 157 feet deep near York, Nebraska, when analyzed showed a tritium number of .41. The rain water has a tritium number of 6. Now allowing the tritium number of the rain water to decrease by one-half, each 12½ years, how many years must elapse to obtain a tritium number of .41? In 12½ years, it would be 3; in 25 years it would be 1.5; in 37½ years it would be .75 and in 50 years it would be .375 which is very close to .41. *This means that the water in the well at York, Nebraska, fell as rain 50 years ago.* This gives us food for thought. Are we mining water? As geologists explore these problems with the new techniques, we may expect much valuable information that will enable us to act wisely in using the ground waters.

Surface Waters

The surface waters present many interesting and difficult problems. Some of these are of a technical or engineering character; some are legal; some are political and involve the difficult art of compromise; some are economic and many of them fall into the area of value judgments; all of them lie in the important field of human relations.

Let me speak briefly of only one of the technical problems, *viz.*, decreasing the loss of water by evaporation from lakes and reservoirs by spreading a thin film of certain substances such as cetyl alcohol over the surface of the water. Experiments on a small scale have shown that evaporation can be decreased by as much as 70 per cent using pans of water. On a large scale the effect of wind and dust must be studied. The material must be permeable to the oxygen or the air and also permit sunlight to penetrate into the waters of the lake or reservoir,

and it must be nontoxic to fish and plant life. It must also be economic in its application. Practical application has been tried in Australia and the results have been very promising. Comparing the results of applying cetyl alcohol to one of two lakes in the same proximity and holding one as a control, the results indicate that 30 per cent reduction of evaporation takes place. Calculations indicate that an application of 300 pounds of the material per square mile of surface might last as long as 10 years. The theory behind these experiments is interesting.

Water is a unique solvent. Organic chemical substances which are closely related to water will dissolve in it. For example, wood alcohol has the formula CH_3OH, water has the formula H_2O, or putting it another way HOH, so that the two compounds have the OH in common, and wood alcohol dissolves in water in all proportions. Grain alcohol, which has the formula C_2H_5OH, dissolves in water apparently for similar reasons. Glycerin has the formula $C_3H_5(OH)_3$ and here again you see it has OHs in common with water and is soluble in it in all proportions. The same could be said for sugar.

On the other hand, one of the substances in gasoline having the formula C_7H_{16} has nothing in common with water structurally and does not dissolve in it. A substance having a long carbon chain, such as cetyl alcohol, and having an OH group at the terminal end, is related to our lubricating oils and water. The OH group will dissolve in water, but the long carbon chain will not, hence this substance forms a very thin film on the surface of the water. This is a promising technological venture and if carefully studied may result in tremendous saving of reservoir and lake waters by cutting down the evaporation rate.

Salt Water Conversion

The salt waters of the oceans offer a continuous challenge to the scientist and engineer as a source of fresh water. The problem here is fundamentally an economic one. For the United States it would seem that using solar heat as the source for the energy needed for distillation offers the greatest promise, but even here the cost will apparently be too high for most purposes.

Problems Resolve . . .

Water problems resolve themselves into questions of time, place and costs. The eastern coast of our country usually has ample precipitation considering the yearly average. Long drouth periods during the summer, such as was the case in 1957, will probably result in increased use of water for irrigation as time goes on. The location of large metropolitan centers at great distances from adequate fresh water supplies is the base for many serious water problems. Cost problems become very difficult when multiple purpose structures are built; and yet efficient use of water usually demands multiple purpose consideration: power, irrigation, navigation, recreation, preservation of wildlife, to mention only a few.

The difficulty of finding truth in situations where there are many unknown and known factors and ingrained prejudices, is demonstrated in our inability to develop a sound water policy acceptable to all our people. Wherever men try to divide water they find themselves in difficulties. Many of our very difficult international problems arise from this effort. The waters of the Indus River between Pakistan and India, the River Jordan in the Near East, the waters of the Nile, La Plata in South America, are all subject to critical controversy. We are just beginning in our own country to hear rumblings over the division of the water of the Columbia. These difficulties also arise when we attempt to divide our river waters between states and even between different parts of the same state.

Irving Fox, of Resources for the Future, in a paper presented to a meeting of the Missouri Basin Interagency Committee, March, 1957, made a very interesting analysis of the recommendations of recent study groups, such as the Cooke Commission, the Missouri Basin Survey Commission, the Second Hoover Commission, and the

A SYSTEM OF CONVERTING sea water to fresh water which could be delivered to an urban water system at about 20 cents a thousand gallons was announced in late October 1957 by an industrial concern. ***(Photo by Gordon H. Brown)***

President's Advisory Committee on Water Resources Policy. In this paper, Mr. Fox finds that policy makers have been concerned with four questions.

First, what are we trying to accomplish through our water development program? That is, what are our objectives in terms of the economic and social well-being of our society?

Secondly, who should conduct the different activities: private institutions, the local community, the state or the federal government?

Thirdly, who should pay for the programs adopted?

And finally, how can the task of developing our resources be organized so as to be conducted most efficiently?

Some Difficulties . . .

No small part of the difficulty lies in the fact that our problems are continuously changing. In connection with the first question, perhaps our major difficulty is that we are trying to bring programs under a single tent that to a large extent seem mutually exclusive. This, of course, is one of the common problems of our day. For example, without any question the great rivers of our country serve the purpose of carrying away the wastes that have accumulated as a result of the activities of society. On the other hand, the same waters are the source of drinking water, and are the source of irrigation water, where pollution becomes a serious problem.

In this connection it is interesting to note how little attention we are paying to the great problem of disposing of waste from our atomic energy activities. The radioactive fission products are being stored today in containers. Can we depend on underground storage for these containers with a possible contamination of soil and water supplies? The Los Alamos Laboratory has already used up 40 acres in underground storage and needs a new site for that purpose. Can we envision storage in the ocean depths with a possibility of an overturn of even stable water sufficient to contaminate marine plant and animal life and thus of all of the lands adjoining the sea? This is a new problem.

Agricultural surpluses continue to plague the nation. Shall we continue to open up arid lands and provide irrigation which will further increase these surpluses, or can we hope to take care of the increased demand for agricultural products by more intensive cultivation of the acres already employed? In the light of the tremendous industrial development which is taking place and demanding ever-increasing quantities of water, must we in our planning provide more water for industry than we do for agriculture? These are some of the problems that we now face in a very serious way.

With respect to the second question, who should conduct the different activities: private institutions, the local community, the state or the federal government? The answers are difficult to give. In a democracy it would seem the part of wisdom to have as much local control over our water uses as it is possible to have. Whatever our private convictions may be, it is a fact that the central government is becoming increasingly pervasive of our total society. The very size of these undertakings seems to send us to the federal pocketbook for funds. If we accept the premise that the federal government should build large scale projects for irrigation, flood control and navigation, it is axiomatic that there will be instances when it will be more economical to provide at the same time for municipal and industrial water supplies, outdoor recreation opportunities, and other needs, than to provide separate facilities for these purposes.

Consider this problem as it applies to three water related activities, namely, flood-plain use, municipal and industrial water supply and outdoor recreation. Traditionally all three of these fields have been the domain of state, local or private entities. However, the federal government is becoming increasingly active in each of them. Policy makers are now confronted with this question: to what extent is it appropriate for the federal government to enter these fields long considered to be state, local and private responsibilities?

The superior financial resources of the federal government and its preemption of many fields of taxation have placed it in a better position than the states are in to make the large capital investments that are required for water development. The large share of the tax dollar taken by the federal government, of course places it in this position. Also, I suspect that the reason that the federal government has to take such a large share of the tax dollar is that it has often seemed easier to get "Uncle Sam" to finance a program and develop a water resource project than to impose the taxes and undertake the task at the local level.

Objective Research Needed

As we struggle with these basic problems involving many unknowns, a multiplicity of known factors and deeply ingrained prejudices, we shall probably have increased sympathy for the old Belgian chemist I told you about at the beginning, who found the wrong answer to the question, namely, does charcoal come from water. The problem itself was too complicated for him to solve with the tools and information at his disposal. The great lesson it seems to me that this has for us is that we must increasingly have objective research to try to unravel the various factors that are involved in our problems.

The purpose of objective research is to find truth, not support, for preconceived convictions, viz., our prejudices. If we learn to do that, we shall have indeed solved one of our very basic problems, namely, that of developing a sound democratic society.

Factors Influencing the Establishment of a National Water Policy

H. E. THOMAS

Some people look upon a national water policy as they might an insurance policy—it is something we have gotten along without so far, but we realize we really ought to have one. To me, says the author, there has always been a national policy; it has been based upon our understanding of water and requirements for water at the time, and has changed (with some lag, of course) as our knowledge of water and our use of water have increased. For most of the history of our country water policy stressed isolation or containment and solution of each conflict individually. Fortunately, the emphasis is now on cooperation, collaboration, and coordination.

A WATER USER—and every citizen is included in this category—does not have a general interest in water resources, but chiefly a special interest in specific sources of water, or in certain aspects of the water resource. Characteristically, each water user is a special pleader for a particular type of use, a particular geographic region or river basin or even a part of that basin, or a particular method of development.

Conflicts among groups of water users dominate the national attitudes: they are reflected in the current policies of individual agencies of the federal government, and in the conclusions and recommendations of students of national water policy. Practically everything the federal government does or can do about water has both its enthusiastic supporters and its conscientious objectors. Some have argued that the federal government should not be involved with water at all, and to support this argument they can point to petroleum as another great liquid natural resource, which is mostly in private ownership and which has been developed almost entirely by private capital and initiative, even where it occurs on public property. Our solid fuels, metals, and other mineral resources too have been developed almost entirely by private initiative. Water, of course, is different from the other mineral resources in that it is generally mobile and renewable, at least to some extent.

Characteristically the natural water supplies fluctuate between wide extremes from season to season and from year to year. Thus they are far from ideal for serving the greatest good of all citizens.

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Precipitation of itself cannot meet the needs of mankind. Water must be stored somehow to be of most benefit—in the soil where it can be reached by crops, in ground-water reservoirs where it serves wells and springs, or along streams, especially where the flow can be regulated by lakes and reservoirs. A great volume of storage is provided by nature, but to obtain maximum benefit from all the water that falls as rain or snow, man must increase the natural storage of surface water, ground water, and soil water wherever possible by artificial means. There is general agreement as to this, and general realization also that by increasing artificially the amount of storage for beneficial use we may also reduce the damage that results from floods and from excessive erosion and deposition of sediment.

The national interest in water-control programs has grown with the increasing significance of water in our economy and the awareness of the diminishing reserve of unappropriated water.

Here, however, is an area of major conflict in water-resource policy: who should pay the costs of these developments, and who should reap the benefits? Here enters the competition among those who want the water for irrigation, industry, municipalities, power, navigation, pollution control, recreation, soil conservation, or fish and wildlife conservation; the competition between upstream and downstream interests. And, if public funds are to pay the cost, the competition among different river basins and geographic regions.

In saying that no one has a general interest in water, I slighted a small group—a few thousand at the most—who have been given the responsibility of studying and evaluating the natural water resources and the effects of water development and use. These scientists are particularly aware of the incompleteness of our knowledge of water

as it has served as a basis for water developments that have already been undertaken. Unfortunately this inadequacy persists with respect to the more comprehensive programs now planned or under way.

But adequate basic information would require far more manpower and funds than have been available in the past, and because of the changes of the water resource in time, the data must be obtained over periods of many years, or even decades. Here the hydrologists come in conflict with the requirements of the American public and the technologists who are given the responsibility of meeting those requirements. The conflict here is between the caution and doubt expressed by the hydrologist, and the impatience of those who want to proceed with specific developments.

"Ownership" of Water

Even the basic philosophies concerning ownership of water, and rights to use water, are at variance in different parts of the country. In some states the water is considered to be accessory to the land and subject to private ownership. Rights to such water are therefore not dependent upon use and are not lost by nonuse. And if there is state regulation of water use, it is on the basis of police power.

In other states water has been declared by statutes to belong to the public, and to be subject to appropriation on the basis of priority of beneficial use. This appropriative right is not dependent upon landownership and can be lost after a designated period of nonuse.

Still other states accept a combination of both doctrines, commonly with some modification.

These contrasting concepts of water rights reflect corresponding contrasts in the hydrology of various parts of the country. Such variance in basic philosophies would militate against establishment of a uniform policy concerning water rights throughout the nation.

The diversity of philosophies concerning water rights in various parts of the country can be traced, at least in part, to the fact that the United States Constitution makes no direct reference to water regulation or control. The states have therefore undertaken to solve problems pertaining to water that remains within their boundaries. After less than two centuries no other branch of law differs so widely from state to state as that pertaining to water.

The isolation of problems has been facilitated, of course, by the fact that water disputes and problems in colonial days and in the first century of the Nation's history were few and far between, both in time and in space. Experts at law have contributed to isolationism by setting up "classes" of water which have no sound scientific basis, and then formulating rules and hypotheses for each class.

Although the Constitution does not give the federal government general powers in water regulation, several specific powers are expressed or implied in the clauses relating to commerce, property, general welfare, treaties, and interstate compacts. The commerce clause has been the basis for federal authority in navigation, hydroelectric power, flood control, and watershed improvement. The property clause has been the basis for activities especially in reclamation, and the general-welfare clause has been the authority for regulations especially in the interest of public health.

Thus there has been a tendency for the federal government to isolate water problems on the basis of use. In addition, the federal government has jurisdiction over waters that flow along or across state or national boundaries. Disputes over these waters have been settled by interstate compacts or international treaties, or by court decisions on the basis of "equitable apportionment."

After 1930 . . .

Until about 1930 water problems were generally separate, isolated, local matters. But in the last two decades this has changed. Two factors appear to be chiefly responsible for this breakdown. One is the natural circulation of water, which results in interrelations of which our forebears were unaware—among precipitation, soil water, ground water, and surface water, as well as among the several artificial "classes" of water. The other is the rapidly increasing use of water, which has pointed up the interrelations that are inherent in the hydrologic cycle.

The water resource is generally renewable, and renewal has come to be expected by water users. Scientists have described the circulating system—the hydrologic cycle—that makes this so: Evaporation of water chiefly from the oceans but also from the continents; circulation in the atmosphere; precipitation as rain or snow; overland runoff, or infiltration into the ground to form soil moisture and, at some times and places, ground water; and flow over the surface or underground until the water either reaches the ocean or is returned to the atmosphere by evapotranspiration.

In the ground-water, surface-water, and atmospheric phases of this cycle, movement of water is dominantly lateral. Because of this lateral movement, surface water and ground water characteristically cross property lines. Exclusive private ownership cannot be recognized to the degree possible with ores, coal, and real property in general. *Water rights therefore are merely rights to the use of rather than the exclusive possession of water.*

On the other hand, water in the soil-moisture phase moves chiefly vertically, and may be contained within property boundaries. Several states acknowledge by statute the private ownership of water that falls as precipita-

tion and accumulates in the soil. The right to water in the atmosphere is a matter not yet resolved in any part of the country.

Withdrawals Increasing

Another distinctive feature of water is the effect of use. It is estimated that the nation withdraws an average of 175 to 200 billion gallons a day of surface and ground water, chiefly for irrigation, industrial, municipal, and rural use. This rate of withdrawal is expanding rapidly: it has increased fourfold in the past half century, and may well be doubled again in the next 25 years. Probably about one-third of the total water used is consumed and returned to the atmosphere. The rest is the waste water from industry, the sewage from cities, and return flow or seepage from irrigation.

Water returned to streams, lakes, or ground-water reservoirs may be reused, although the first use generally has caused some deterioration in quality. Thus, in addition to the fact that water moves naturally from one man's property to another's, the use of water by one man on his own land can affect either the quantity or the quality (and frequently both) of the water available to another man.

Coordinated Planning Needed

Cooperation and compromise as a means of resolving water problems date back almost to the beginning of development of the water-deficient West. Nevertheless, there have been enough disputes to give the courts opportunity to construe some of the major problems in water rights. In the past half century the bases of allocation of water have been specified in statutes, interstate compacts, and international treaties. Practically all these instruments represent compromises that have been made necessary because of the physical limitations of the water resource.

In water development there has been progress in many parts of the nation. These range from special-purpose projects (each an end in itself) to multiple-purpose projects (achieved largely by addition of the expressed needs of various special-interest groups and then cut down by compromise to fit the physical limitations of the water resource).

Interagency committees, composed of representatives of the various agencies concerned with some aspect of water development and use, represent another step in the trend toward cooperation and coordination. A first achievement of these committees was the breakdown of the earlier isolation of efforts and increased understanding by each agency of the work being done by other agencies. Subsequently, these interagency committees have become increasingly important in coordinated planning of comprehensive development.

Proposed Integration

In recent years, recommendations on national water policy have been made by the President's Water Resources Policy Commission (*A Water Policy for the American People*, 1950) and by the Presidential Advisory Committee on Water Resources Policy (*Water Resources Policy*, 1955). In addition, the Commission on Organization of the Executive Branch of the Federal Government (Hoover Commission) has made a comprehensive study of water and power policies and organization. The reports by these committees differ in details, but all point to the detrimental effects of the piecemeal and stopgap measures, and the various inconsistencies.

The recommendations of committees appointed under both the present Administration and its predecessor stressed the need for increased coordination and cooperation among federal, state, and local agencies. The proposed integration of efforts in water development includes comprehensive planning on a cooperative basis, and organization for more effective coordination and review of projects.

"What Are Basic Data?"

With particular respect to basic hydrologic information, the reports of the several presidential committees are in agreement as to its inadequacy for sound planning. Indeed, the demand for the collection of more basic data is being heard in more and more places, and this demand is already resulting in reams of statistics.

Here one may well ask, "Is the collection of more and more basic data answering the country's needs?" This in turn poses the question, "What are basic data?"

As of today the basic-data programs are geared to the needs and definitions of the hydrologist rather than to the needs of the public generally—a necessary evolutionary stage—as indicated by one of the recommendations of President Eisenhower's advisory committee:

> *"There should be a marked increase in the interpretive and evaluative studies of the basic data. With respect to federal funds allocated to basic-data agencies, not less than five percent of the funds allocated to each field of data, such as meteorology or stream gauging, should be used for evaluative studies, including research and development, in order that this aspect of the data-collection effort may be brought into balance with the need."*

One opportunity for integration that deserves more consideration is the interrelation of basic-data and development programs. The pressure for development cannot be denied: the population is increasing now, soil erosion and damaging floods are matters of present concern, water shortages have already developed. But it is not a necessary corollary that, having ventured forth on a development project without adequate basic data, we might as well ignore the hydrology of the project area

henceforth. Rather, the development projects now underway can be the basis for a far better understanding of the water resources, provided the development is accompanied by a basic-data program sufficient in scope to permit adequate current evaluation of the effects of development. Unfortunately, the basic data collected in connection with most development projects—federal, state, or private—have been limited to those necessary for operation and maintenance of the project. It is coincidental if these data show the effects of development upon the natural resource, because the data-collection program was not planned that way.

A Major Difficulty . . .

A major difficulty in the evaluation of the effects of specific projects upon the water resources has been the inadequacy of funds set aside for the purpose. A good example is the expanding national program of watershed improvements. Of 65 pilot watersheds complete evaluation of hydrologic changes is planned for only eight. The evaluation program is limited to about five per cent of the federal funds appropriated for the pilot watersheds. The funds set aside for evaluation of projects undertaken under Public Law 566 and its successor are similarly meager to date, and will provide an adequate evaluation of only a small proportion of the projects.

The evaluation of the effects of any development project should be undertaken by hydrologists and agencies independent of those responsible for the development, because a man cannot be expected to be disinterested and impartial toward a project that he has planned, constructed, or otherwise developed. This statement is not by any means intended as a reflection upon the integrity of the personnel in development agencies or upon their competence in hydrology. Rather it is a recognition that the development agencies necessarily have a proprietary interest in their projects sufficient to defend them against critics.

The necessity for greater integration of effort in water-resources development and use, and the difficulties of achieving such integration, are recognized by practically all who have studied water problems. They are summed up, for instance, in the letter transmitting the Presidential Advisory Committee's report to President Eisenhower:

"Many of the issues with which this report deals are highly controversial. They have been debated by the Congress and the public for many years. Establishing a program looking to the best interests of the nation as a whole, which gives recognition to the legitimate interests of the states and the people directly affected by water development, means that we cannot blindly follow the patterns and traditions of the past."

MULTIPLIED to infinity the impact of a raindrop is felt in everything we do on the planet Earth. Call it what you will—splash erosion, silt, soil impaction, flash runoff, loss of soil porosity. Raindrops multiplied reach into the hydrologic cycle and soil fertility and even into our minds and actions. Has ultra-highspeed photography shaken us free from some of the "patterns and traditions of the past"? ***(S.C.S. photo)***

Conservation Crop Rotations in the Pacific Northwest

RAMON L. KENT

The author compares "conservation rotations with continuous cropping using nitrogen fertilizers in the Palouse area of the Pacific Northwest." Sloping lands and low rainfall averages are characteristic. By following practices recommended the soil is given more protection against erosion, organic material is restored and annual soil moisture is used more efficiently. Another advantage is that more livestock can be carried on present acreages when grasses and legumes are used in rotation.

IN WASHINGTON, IDAHO AND OREGON there are about 19,000,000 acres of cropland. More than 4,000,000 acres are now irrigated and about 8,292,000 acres are dry-farmed in the Palouse and Columbia Basin areas of the Pacific Northwest. Wheat and peas are major crops.

Probably between 2,850,000 and 4,000,000 acres of the dry-land wheat and pea area of Washington, Idaho and Oregon can be continuously cropped most of the time. This would represent the rather wide range of 14 to 25 inches total annual precipitation. Any extension of the area to be annually cropped is to be encouraged because summer-fallow under annual precipitation of 14-25 inches is subject to severe erosion. (Annual cropping as used in this discussion means a crop every year instead of every other year such as wheat one year and fallow the next.) We can also say, from estimates made by Soil Conservation Service land and water inventories, that about two-thirds or 2,000,000 acres have 5 to 30 percent slope. In addition, about 750,000 acres are classified with more than 30 percent slope and are best suited to producing forage crops.

Annual cropping can benefit by the use of nitrogen fertilizer, but the increase of soil organic matter and erosion control can best be attained through the use of a crop rotation using grasses and legumes, supplemented by nitrogen fertilizers as needed for the cash crops.

A study of the values of a crop rotation is a very definite need over much of the sloping lands in the wheat-pea area of the Pacific Northwest. Wheat and fallow is sometimes known as a rotation, though it is the kind that has caused a reduction of our plant food reserves and depleted the organic matter in the soil.

An examination of the data pertaining to rotation of crops for the Pacific Northwest drylands reveals some information that may be applied in developing a farm conservation plan for farms in this area subject to serious water erosion. Several advantages of rotating crops can be listed; the more important are:

1. Reduction of soil losses in an area of serious water erosion
2. Maintaining or increasing yields
3. Helping to maintain organic matter and nitrogen in the soil
4. Helping to make it possible to use other soil conservation practices such as strip cropping, mulch farming, contour operations and nitrogen fertilization in a more systematic way
5. Using labor more efficiently throughout the year
6. Assisting in weed and insect control
7. Providing forage for livestock.

The value of organic matter, and the need to replenish the supply, must always be a basic objective in a critical water erosion area. Organic matter does at least four importants jobs in maintaining our soils:

1. Contains important plant food
2. Helps store water and improve infiltration rate
3. Improves soil tilth
4. Helps to control erosion.

F. J. Sievers and H. F. Holtz reported in 1922 at Pullman, Washington, that during a period of 39 years under a wheat-fallow system, 34.5 percent of the soil organic matter and 22.1 percent of nitrogen had been lost from the soil. In this annual crop area, soil analyses now show that about 40 percent or more of the soil's organic matter and about 50 percent of the soil nitrogen have been used up by cropping and erosion losses.

Field observations at the Pullman Soil Conservation Experiment Station indicate that erosion losses in the annual cropping area are greatest where winter wheat is grown on clean fallow. The rate of loss is influenced significantly by how well the cover of winter wheat has been established. A large portion of the 14-20 inch rainfall belt gives higher yields of winter wheat than of spring wheat. So winter wheat will be an important crop for a long time to come; and would appear that many of the conservation practices used will need to be built around a winter wheat crop.

Studies made by Washington State Experiment Station and the Soil Conservation Service Research Station in 1946 gave the best comparison of virgin land to land

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ORGANIC SOIL BANK . . .

15,000 pounds of roots per acre in the top eight inches of these soil and grass samples taken at Pullman Plant Materials Center. ***(S.C.S. photos)***

that had been cropped about 40 years. These comparisons were made on the use of the land under the wheat-fallow system of cropping.

Runoff and soil losses from 40-year-old cultivated land and from adjacent land broken out from sod in 1934 and cropped to wheat alternating with summer fallow are shown below. The results show that the newer land, which has a higher organic matter content, absorbed water more rapidly and was more resistant to erosion than land that had been cropped for a long time.

TABLE 1. Comparison of virgin land and old land under wheat-fallow croppings at Pullman, Washington, 2,350 feet.

	Organic matter (percent)		Total water loss inches	Total soil loss per acre (tons)
	1936	1946	1935-46	1935-46
Virgin land	3.9	3.5	0.11	0.2
Old land	2.3	2.3	4.17	16.6

The Tetonia branch station of the Idaho Agricultural Experiment Station and Soil Conservation Service Plant Materials workers found on land that had been cropped 26 years with the wheat-fallow system (Table 2), that this system of farming had caused 50 percent reduction of the soil organic matter.

TABLE 2. Comparison of organic matter measurements.

	Average organic matter (percent)
No cropping, mixed grasses	3.4
20 years wheat-fallow, 6 years big bluegrass	3.708
26 years wheat-fallow	1.73

These results show that in the southeastern part of Idaho elevation of 6,200 feet the organic matter can be restored through certain rotations to as much as, or more than, its original level.

The effects of rotations at the Soil Conservation Experiment Station at Pullman, reported by Horner in 1950, showed that alfalfa and sweet clover improved soil fertility and reduced erosion. The highest production of wheat was obtained from the use of sweet clover and grass as a green manure with a yield of 45 bushels in 1950 and a 10-year average yield of 41.9 bushels. This was about 50 percent greater than the yield of wheat on check treatments of wheat-peas and wheat-fallow rotations.

The organic matter was maintained or increased in the alfalfa-grass plots over the 1936-48 period. The sweet clover-grass rotation showed a similar maintenance of organic matter. These plots were on sloping lands where the original fertility had been reduced by cropping, water erosion and plow erosion.

The rates of infiltration, erosion and runoff on land in winter wheat under different cropping systems during the December 1945 storm at the Soil Conservation Experiment Station at Pullman are given below:

Crop	Rotation	Rate of infiltration	Runoff, percent	Soils loss tons/acre
Winter wheat	Alfalfa-grass, wh. wh. p. wh.	.36	9	5.5
Winter wheat	Sweetclover-grass, wh. p. wh.	.17	16	11.9
Winter wheat	Wheat-peas	.10	27	21.8
Winter wheat	Wheat-fallow	.06	44	33.0

Data are for second wheat crop in alfalfa-grass rotation and for first wheat crop in sweet clover-grass rotation.

Studies on plots at the Plant Materials Center (Soil Conservation Service) at Pullman, Washington, show the amount of roots produced eight inches in the surface to be surprisingly large. This points up clearly why grass and legume roots help control erosion.

TABLE 3. Yields of roots and tops on alfalfa-grass plots at Plant Materials Center, Pullman, Washington.

	Pounds per acre		
Species	Alfalfa	Grass	Total
Hard fescue	3,840	11,328	15,168
Crested wheatgrass	3,356	8,896	12,352

It was noticed at the center that alternate-row seedings of sweet clover and grass produced 10,760 pounds of roots and tops. This is the dry-weight amount of residue that was added to the soil for erosion control and organic matter maintenance in two years as a green-manure crop.

It is known that roots of grass and legume plants function to improve soil tilth. They develop and stabilize soil aggregate, increase porosity as roots die and decay and leave channels in the soil and increase the total organic matter supply of the soil.

Holtz and Vandecaveye (1938) also found that field applications of (1) various organic residues, (2) nitrogen fertilizers alone, or (3) nitrogen fertilizers as a supplement to the organic residues did not result in an appreciable increase in yield under alternate cropping and summer fallow. On an average these practices resulted in

substantial increases in yields of wheat under annual cropping. The increases were roughly proportionate to the amounts of nitrogen applied to the soil. Nevertheless, yields under annual cropping gradually declined regardless of soil treatment.

The Idaho Agronomy Department, as reported by Baker (1952), found that in a 22-inch rainfall belt, with all residues returned to the soil, crop rotations gave the highest yields of wheat.

TABLE 4. Wheat yields in bushels per acre under various rotations and fertilization systems, Moscow, Idaho, 1938-1951.

Wheat-fallow	Nitrogen applied to continuous wheat		Wheat-pea		Rotations	
58.5 bu.	Check	24.2 bu.	Wheat	49.0 bu.	Peas—sweet clover	21.1 bu.
	20 lb.N.	29.0 bu.	Peas	20.5 bu.	Sweet clover. Green manure plowed down	2.8 tons
	30 lb.N.	33.0 bu.			Wheat	60.2 bu.
	40 lb.N.	34.0 bu.			Wheat	39.9 bu.

Significant increases in yields followed the application of fertilizers at the Pendleton Experiment Station in the 13-14-inch annual rainfall belt (Stephens, 1944). The importance of soil fertility has been vividly shown by the fact that under the wheat-fallow system the plots at that station receiving manure and utilizing all crop residues gave the highest average yields for all plots on the station. With fertility requirements satisfied through the application of manure at 10 tons per acre, the wheat yield was 3.5 bushels per inch of precipitation in an average crop year, as compared to a yield of 2.5 bushels per inch of precipitation on land not fertilized.

Langley and Jacquot (1952) estimated that during the 1952 spring runoff near Hooper, Washington, soil losses were reduced about one-half (or an average of 20 tons per acre) on a 20-percent slope. Here fall wheat was seeded on a fall-prepared seed bed with a one-way disk that left a fair amount of surface straw, and nitrogen fertilizer was applied. Fall wheat seeded on conventional summer fallow with mulch as a surface served as the comparison. A similar field study near Endicott, Washington, by Horner and Kent (1952) indicated a soil loss of less than two tons per acre for a crop rotation on a strip-cropped farm, as compared to average losses of 15 to 60 tons per acre on conventional wheat-fallow with fertilizer.

A cooperative study initiated in 1947 by the State College of Washington and the Soil Conservation Service for a five-year period has given some very interesting results. The purpose was to compare a grass-legume rotation system of farming with the more common wheat-pea system from the standpoint of production, economic returns and the effect on soil losses. Three pair of farms similar in size, tenure and physical characteristics were selected, the main difference being the grass-legume rotation as compared to the wheat-pea rotation. This study showed that on the grass-legume farms:

1. Wheat and pea production was 17 percent higher
2. Net crop income per acre was about 38 percent greater, even though costs of labor, machinery, seed, etc. were also higher
3. Soil losses from erosion from 1948 through 1950 were less than one-third as great.

The rotations of grass and legumes usually required about 20 to 30 percent of the cropland area on each farm. The Soil Conservation Service Plant Materials Center reports that annual yields of 1.5 to 4.0 tons of forage from alfalfa-grass are possible.

Results of pasture trials at the State College of Washington further indicate that second-year sweet clover and grass will produce 200 to 300 pounds of beef per acre. Pasture trials with alfalfa and grass have produced as high as 250 pounds of beef per acre from six weeks of grazing.

HEAVY equipment plows down sweet clover on J. W. Cornwall ranch near Fairfield. The organic material is most worthy.

STUBBLE mulch tillage is a recommended soil conservation practice in the Southeast Okanogan district.

SMOOTH bromegrass for seed production and crop rotation on August Reinbold's farm in the Davenport-Reardon soil conservation district.

HARVEST scene near Edwall. The 120-foot wide strips, combined with a conservation rotation, help in reducing soil losses to as low as 2 tons per acre.

All of these values that have been pointed out are important; they are especially important on sloping lands, which are predominant in the annual-cropping area of the Northwest. For this reason, a cropping system that is to be effective should add organic matter through the periodic use of grasses and legumes.

In the annual-cropping areas of the Northwest, the use of stubble for the principal erosion-control measure is complicated by the wide variance in the quantity of stubble produced on different kinds of land. Clay hilltops, which may yield only 10 or 15 bushels of wheat per acre, produce relatively light stubble compared to the dense stubble on areas with a yield of 50 or more bushels. It is apparent to those who have studied these clay hilltops and other severely eroded or shallow lands that they need more than just fertilization. A soil-improving, grass-legume rotation has given many times more erosion control.

A field survey by workers of the Soil Conservation Service in 1948 indicated that legumes such as sweet clover, and especially sweet clover and grass mixtures, grown in rotation with other crops, measurably reduced soil loss by erosion. This survey also indicated that the value of legumes and grasses in rotations increased with the number of times such crops were grown. Fields that had been through two complete rotation cycles suffered far less than those that had been through only one grass-legume rotation.

Conclusions

A large part of the experimental data and field observations in the annual cropping area of the Northwest indicates that a crop rotation of grasses and legumes is needed for sloping lands, clay hilltops and other severely eroded areas. The use of hay, pasture and silage produced in the annual cropped area of the Northwest should make it possible to increase livestock numbers.

Nitrogen fertilizers will continue to be needed to supplement a sound crop rotation in order that the year's annual soil moisture supply can be efficiently used. Fertilization also helps balance the carbon nitrogen ratio when heavy amounts of grass residues or straw are returned to the soil.

Slopes, soils and cropping practices vary widely. It is evident that other conservation practices such as strip cropping, contour operations, stubble mulching and early seeding of fall wheat and spring grown crops will continue to be important on dry farm lands in the Pacific Northwest.

Grasses and legumes improve soil structure, aid in soil protection and improve crop productions.

LITERATURE CITED

Baker, G. O. 1952. *Unpublished data.* Agronomy Department, University of Idaho.

Baker, V. W., and J. P. Swanson. 1952. *Economic effects of grass-legume rotations in Palouse wheat-pea area.* Sta. Cir. No. 183. State College of Washington.

Holtz, H. F., and S. C. Vandecaveye. 1938. *Organic residues and nitrogen fertilizers in relation to the productivity and humus content of Palouse Silt-Loam.* Soil Science, 45: 162-163.

Horner, Glenn M. 1950. *Progress Report.* Soil Conservation Experiment Station, Pullman, Washington. Mimeographed.

———. 1952. *Unpublished data.* Soil Conservation Experiment Station, Pullman, Washington.

——— and R. L. Kent. 1952. *Estimates of soil erosion losses, near Endicott, Whitman County, Washington. Unpublished Field* Erosion Survey.

Langley, Glenn, and Harley Jacquot. 1952. *Estimates of soil erosion losses near Hooper, Whitman County, Washington.* Unpublished field erosion survey.

Sievers, F. J., and H. F. Holtz. 1922. *The silt loam soils of eastern Washington and their management.* Bul. No. 166.

Stark, R. H., A. L. Hafenrichter, and W. A. Moss. 1950. *Adaptation of grasses for soil and water conservation at high altitudes.* Jour. of Agronomy, 42(3): 125.

Stephens, D. C. 1944. *Conservation practices on wheat lands of the Pacific Northwest.* Pendleton Experiment Station. Mimeographed Report.

Research Toward a Highly Productive Agriculture For Puerto Rico's Humid Mountain Region

JOSE VICENTE-CHANDLER AND ROBERT W. PEARSON

Two and a quarter million human beings live on less than 2¼ million acres in Puerto Rico. A major portion of the "land-conservation" problems of the island is to be found in the steep humid mountains of the interior. And, in this same interior, based upon careful research under way since 1948, is to be found a great potential for agricultural development and the improvement of the well-being of some 400,000 people.

THE TROPICAL island of Puerto Rico is one of the most densely populated countries in the world, with about 2,250,000 people living on approximately 2,150,000 acres of land.

Only about a quarter of the land is relatively level. Almost all of this level land is found on the coastal region surrounding the mountainous interior. Erosion is a minor problem on this land particularly since sugar cane, a soil conserving crop, is grown on most of it. Some fields, indeed, have been in sugar cane continuously for over a hundred years, yet the soil shows no sign of deterioration.

About another quarter of the island's surface is suited only to woodland because the soil is too shallow, rocky, or wet. Since this land cannot be used in any other way, much of it is already in forests, a considerable portion of which is owned by the government. Excellent forestry research and action programs are already underway in the Island through the cooperative efforts of the United States and Commonwealth governments.

1/ TYPICAL VIEW in the humid mountain interior of Puerto Rico where the present situation is small wooded and unproductive coffee plantations, eroded pastures and clean-tilled fields, and a low-level economy. Caonillas lake (foreground) provides power to industries and irrigation for the semi-arid south coast.

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The bulk of the conservation problems of the Island are found on the remaining half of the land area (about one million acres) in the steep, humid mountains of the interior. The results of the research described in this article show that here also lies by far the greatest potential for agricultural development in Puerto Rico.

The Humid Mountain Region

Figure 1 shows a typical view in the humid mountain region of Puerto Rico. The seriousness of the erosion

2/ SILT almost fills this hydroelectric reservoir (age, 40) near Comerio in the heart of the mountains.

3/ OVERGRAZED, unproductive and eroded pastures are prevalent in the mountains. Three to five acres are required merely to keep an animal alive.

problem is dramatized by the rapid siltation of the vital hydroelectric reservoirs (Fig. 2). Most of the land in the mountain region is in native pastures consisting of unproductive, volunteer vegetation of low quality. These pastures receive little attention, are invariably overgrazed and the soil exposed to erosion (Fig. 3). From three to five acres of such pastures are required to keep an animal alive to say nothing of producing efficiently.

About 175,000 acres are in more or less abandoned, old coffee plantations (Fig. 4). Little care is given the coffee and the vegetation covering the soil is cut back close to the ground twice a year exposing the soil to erosion. Yields average only about 150 pounds of market coffee per acre compared to average yields of about 400 pounds obtained in the other coffee-producing countries of Latin America.

About 50,000 acres in the mountain region are in clean tilled crops such as tobacco, corn, sweet potatoes, etc., which leave the soil exposed to severe damage by erosion (Fig. 5). A haphazard rotation is usually followed with volunteer native pasture coming after the clean tilled crops.

Due largely to the low productive level of agriculture, family income in the mountain region averages only about $300 yearly. As a result, workers migrate in large numbers to continental United States and to the larger cities of Puerto Rico where they often create serious employment problems. Although Puerto Rico's industrialization program (Operation Bootstraps) has made spectacular progress it cannot provide employment for the large number of unskilled laborers constantly arriving from the mountain region.

The lands of the mountain region are extremely steep, the median slope being about 45 percent. The temperature is warm throughout the year averaging about 75 degrees F. with a seasonal variation of not more than 10 degrees. Rainfall is abundant (about 75 inches yearly) and is fairly well distributed so that plant growth is rarely limited by a lack of moisture.

The soils have excellent physical conditions and are frequently very deep. They have a relatively high organic-matter content and moderate exchange capacities but many are very acid. Fertilization is essential to economic crop production on all of this land. This is not a serious limitation since there is an excellent network of roads throughout the region and fertilizer and lime are readily available. The warm year-round climate, abundant moisture at all seasons, and the deep, friable soils could constitute a sound basis for a highly productive agriculture in the mountain region of Puerto Rico.

The main disadvantage of the mountain region is its rugged topography which favors erosion and precludes

4/ WEAK, heavily defoliated coffee plantation trees under dense shade in Puerto Rico yield on the average about 150 pounds per acre yearly.

mechanized crop production. This disadvantage, however, can be overcome through the use of crops which protect the soil or can be cultivated in such a way as to be soil conserving. In view of the heavy population pressure, ideal crops for the mountain region would be capable of producing a high income per acre and would also have high labor requirements. Coffee and forage crops can meet these requirements as will be shown later.

In addition, forages and coffee have excellent market possibilities. Puerto Rico's annual imports of milk and meat products are valued at about 36 million dollars. These products could be produced economically on the island by a livestock industry based on intensive production of high quality forages. The possibility of such production has been shown by the research discussed later. Coffee is currently the largest import item in the United States (more than 1 billion dollars annually), and Puerto Rico is the only area under the American flag capable of producing a large amount of high quality coffee. Puerto Rican coffee is mild and of excellent quality, and is used for blending with inferior coffees.

The research described later shows that extremely high yields of coffee can be produced in Puerto Rico's mountains. It could be sold at competitive prices on the world market. The stable political situation on the island, its excellent communication system, relatively enlightened farmers and abundance of trained agronomists would strongly favor Puerto Rico in competition with other coffee-producing countries.

Accomplishments of the Research Project

IMPROVED PASTURES—A pasture consisting of tropical kudzu (*Pueraria phaseoloides*) and molasses grass (*Melinis minutiflora*) has been developed and its management requirements and productivity under conditions typical of the humid mountain region determined. These pastures have been shown to be highly productive and almost ideally suited to this region.

An extensive grazing experiment now in its sixth year has shown that kudzu-molasses grass pastures can carry one head per acre throughout the year and produce about 500 pounds gain in weight per acre yearly. This is more than three times the production on native grass pastures. This experiment is being carried out on 50 percent slopes of eroded, shallow Mucara clay under conditions typical of the humid mountain region (Fig. 6).

During the last three years, groups of young, high grade, Holstein dairy heifers were raised on these steep pastures with no concentrate feed. Gains in weight per hiefer averaged 425 pounds yearly. These pastures have not been mowed, weeded, or fertilized since they were established, yet are in better condition now than at the start of the study. The soil is almost perfectly protected against erosion and its organic matter and nitrogen content have increased by more than 50 percent in six years (from about 2.5 percent to 4.1 percent organic matter).

Tropical kudzu-molasses grass pastures are easy to establish. Unlike States kudzu, the tropical, is propagated by seed. It is only necessary to furrow native pastures at three-foot intervals on the contour and then seed alternate furrows to kudzu and molasses grass followed by a light application of fertilizer. Within six months to a year all other grasses and weeds are choked out by the rank growth of the kudzu and molasses grass, and the pastures are ready for grazing. Measurements have shown that the kudzu provides the pastures with about 200 pounds of nitrogen per acre yearly which it takes from the atmosphere. Protein content of the mixture averages about 14 percent.

5/ ON these steep slopes a crew is planting tobacco. The land in the foreground is badly rilled and a large eroded gully can be seen to the right of the laborers in the background. This is near the dam shown in figure 2.

6/ TROPICAL kudzu-molasses grass experimental pastures at Orocovis show little erosion. They are on 50 percent slopes.

Tropical kudzu-molasses grass pastures do well on the steep acid soils of the mountain region with only occasional light applications of lime and phosphorus required for maximum productivity. At least 200 pounds of nitrogen must be applied per acre yearly to improved grass pastures in the mountain region before they approach the productivity of a kudzu-molasses grass mixture. Cost of purchasing and applying this fertilizer in the mountain region comes to about $40 per acre yearly.

Neither tropical kudzu nor molasses grass has serious disease or insect pests. When properly managed, they compete successfully with the many vigorous weeds which abound on the Island. These forages also "keep" well so that mowing is not necessary even when grazing is delayed for long periods. This is a very important advantage since on the steep slopes of the mountain region all mowing must be done by hand using "machetes", and is therefore extremely expensive. Another advantage of these forage species is that they do not become pests to row crops. They can be readily killed out by overgrazing followed by plowing. Thus, they are well suited for rotation or strip cropping with clean-tilled crops.

Use of tropical kudzu-molasses grass pastures is rapidly spreading throughout Puerto Rico's mountains with thousands of acres already in production. Many countries of Latin America have adopted kudzu-molasses grass and reports indicate excellent results wherever climatic and soil conditions are favorable.

FERTILIZED GRASS PASTURES—In densely populated Puerto Rico it may some day be necessary to feed more than one head per acre, which at present seems to be about the best that can be expected of grass-legume pastures. The alternative is to use pastures of highly productive grasses well fertilized, particularly with nitrogen.

Several detailed experiments are being conducted to determine the response of the major forage grasses of the Island to fertilization under conditions typical of the mountain region. The experiments show that these grasses are responsive to nitrogen fertilization up to about 400 pounds of actual nitrogen per acre yearly. Lime, phosphorus and potash are also important factors at high-yield levels.

The data obtained from these experiments indicate that heavily fertilized grass pastures can keep about two head per acre throughout the year on the steep lands of the humid mountain region of Puerto Rico. This, however, would require application of about $70 worth of fertilizer annually. At present, it is more economical to use kudzu-molasses grass pastures.

CUT GRASS FORAGE—Many small farmers in the mountain region must provide milk for their families on very small plots of land. Dairy farmers who generally keep their herds on expensive land near towns must also realize maximum productivity from their land.

Napier grass (*Pennisetum purpureum*) and Guinea grass (*Panicum maximum*) are the highest yielding grasses for cut feed in Puerto Rico. Their fertility and management requirements have been worked out in detail through research conducted by this project. These studies show that, with heavy fertilization and intensive management, the productivity of these grasses can be increased several fold to give about 80 tons of green forage per acre yearly on steep slopes in the humid mountain region. That's enough to support five dairy cows per acre. This is a form of intensive land use together with excellent protection of the soil on steep slopes.

COFFEE GROWN IN FULL SUNLIGHT—In order to compete with other countries of Africa and Latin America where low wages are paid, the rate of coffee yield in Puerto Rico must be high. Previous research had indicated that shade was essential for coffee production on the island. At present, coffee in Puerto Rico is grown under shade trees which compete for light, moisture and nutrients. A low growth rate and yield of coffee results.

Research now shows that with proper, *intensive* culture, Arabica coffee of the Bourbon variety will not only grow in full sunlight but will come into production at an earlier age and produce high yields in the mountains of Puerto Rico. Only two years after planting it produces 600 pounds of market coffee per acre (Fig. 7). In another planting three-year-old coffee growing on a 45 percent slope produced 2,200 pounds of market coffee per acre. In the fourth year 2,500 pounds of coffee were

7/ GROWING in full sunlight and INTENSIVELY managed, this experimental Arabica coffee plantation at Castaner produced 600 pounds of market coffee per acre two years after planting and 2,200 pounds one year later. Researcher Jose Vicente-Chandler examines one of the trees.

harvested per acre. When compared to the present average production of only 150 pounds per acre such yields can mean a revolution in the Puerto Rican coffee industry.

Practices essential for the production of high yields of coffee in full sunlight in Puerto Rico are simple: (1) use of the Bourbon variety, (2) planting in hedges on the contour, (3) heavy fertilization (the trees often die after producing one small crop if no fertilizer is applied), (4) control of insects and disease, (5) proper pruning, and (6) maintenance of good ground cover between the hedges of coffee.

BANANAS AND PLANTAINS—Plantains (a cooking banana) and bananas are a staple in the diet of most Puerto Ricans and are capable of producing up to 20 tons of fruit per acre. These crops, normally clean cultivated on steep slopes, result in heavy erosion.

Research has developed a method for growing these crops close together in two-row contour hedges with a strip of kudzu-molasses grass growing between hedges (Fig. 8). After two years the field reverts to kudzu-molasses grass pastures for two to four years after which it is again planted to bananas or plantains.

In one experiment carried out on a 50 percent slope, soil losses were reduced from 95 tons to seven tons per acre yearly with this method as compared to clean cultivation. With both types of cultivation about 20 tons of plantains were produced per acre.

In addition to conserving the soil this method has other advantages. No nitrogen fertilizer is required since the tropical kudzu provides it in adequate quantities. Weeding costs are reduced since the plaintains or bananas shade the ground under the hedges thus helping to subdue weeds. The strips of kudzu-molasses grass need only be cut back occasionally at slight cost. Finally, cost of land preparation is reduced since only about half of the land is plowed.

Implications of These Findings

What would development of the humid mountain region of Puerto Rico along the lines indicated by this research mean to the Island and its economy?

First of all, a permanent, highly productive agriculture would be established on the steep slopes of the mountain region which are now producing little.

Second, the soil erosion problem of the Island would be largely solved through the establishment of proper land cover. This would, in turn, insure maximum conservation of the limited supply of water for industries, irrigation, and other uses.

COFFEE—By far the greatest opportunity for increased agricultural production lies with coffee. The research discussed above shows that with intensive culture up to 2,500 pounds of market coffee can be produced per acre in Puerto Rico's mountain region. Current farm price of coffee is about 50 cents per pound. Although about 300,000 acres in the mountain region are well suited to coffee production, approximately 50,000 acres would probably be used for home sites, vegetable patches, pastures for the family cows, etc., leaving about 250,000 acres for actual coffee production.

8/
PLANTAINS are grown for food, but under clean cultivation soil losses are about 95 tons per acre. By alternating the hedges of plantain with tropical kudzu-molasses grass strips soil losses were reduced to 7½ tons. And, when the plantains die an excellent pasture is ready for grazing.

Assuming average yields of only 1,500 pounds of coffee per acre and a long term farm price of only 40 cents per pound, this land could produce 375 million pounds of coffee yearly with a value of $150 million. This is almost as much as the total value of Puerto Rico's current commercial agricultural production (valued at about $163 million). It should be borne in mind that this increased production would be attained on very steep land which is at present producing little and is suited to few other uses.

Aside from the high income that such an enterprise could produce, there is another great advantage. Coffee is well suited to development on family-size farms since the labor required is intensive and not adapted to mechanization. Cooperatives could easily provide the needed processing and marketing facilities, arrange for credit, etc. Development along these lines could be a great advantage in densely populated Puerto Rico and could provide the basis for a large, stable, prosperous population in the mountain region.

Under the assumptions stated previously, an acre of coffee could produce an annual income of $600 with costs other than labor of only about $100. A farmer could easily care for three acres of intensively managed coffee from which he would derive a net profit of about $1,500 annually—five times the present average family income in the mountain region. A total of about 80,000 families (or about 400,000 people) could thus prosper in the mountain region from which there is now a rapid migration to the larger cities and to the continental United States.

FORAGES—There are about 600,000 acres in the humid mountain region of Puerto Rico that appear to be best suited for permanent improved pasture for raising beef and dairy animals. All the heifers required as replacements by the dairy herds of the Island could be raised on about 100,000 acres of kudzu-molasses grass pastures in the mountain region. They could produce an income of about $10 million annually to the farmers of this region while saving the dairy farmers of the coastal areas a considerable amount of money and trouble. Several thousand acres of kudzu-molasses grass pastures in the mountain region are already being put to this use.

The remaining half million acres, if used for kudzu-molasses grass pastures could produce about 50 million pounds of beef with a value of some $16 million annually. This would more than meet the Island's present demand for beef and do away with current heavy imports of this product. If market conditions were favorable, production of meat could be greatly increased through the use of heavily fertilized grass pastures.

The use of intensively managed grasses for cut feed could solve the problem of the vast number of small farmers in the mountains who must provide milk for their families while using as little land as possible. Two cows and their calves could be fed on only one-half an acre of Napier grass near the home.

Also, through the use of these intensively managed grasses, dairy farmers could more than double their production of milk without using any more of the expensive land near the towns where most of them are located.

Summary

The conservation problems of densely populated Puerto Rico are concentrated on about half of the land area in the humid mountain region of the interior. The year-round growing weather, abundant rainfall and friable soils of this region can provide the basis for a highly productive agriculture. The problem presented by the extremely steep slopes can be solved by growing crops such as forages and coffee which protect the soil and do not require or are not adapted to mechanization. However, because of heavy population pressure, these crops must produce high yields if they are to be grown economically in this area.

Under present practices from three to five acres of native grass pasture are required to keep an animal alive. Coffee yields are only 150 pounds per acre compared to 400 pounds elsewhere in Latin America. Clean tilled crops are grown on steep slopes with little protection against erosion. Hydroelectric reservoirs are rapidly filling with silt. Workers are migrating from the mountains to the large cities and to continental United States in large numbers.

In 1948 a research project was set up between Soil Conservation Service, the Agricultural Research Service, and the Experiment Station of the University of Puerto Rico to study problems related to soil and water conservation in Puerto Rico. The main accomplishments of this project to date may be summarized as follows:

1. Development of a tropical kudzu-molasses grass pasture mixture which is almost ideally suited to the mountain region of Puerto Rico. Under typical conditions these pastures carry one head per acre and produce about 500 pounds of beef per acre yearly.

2. It has been shown that it is possible to carry 2 head per acre on heavily fertilized grass pastures.

3. Intensive management practices have been devised through the use of which grasses on steep slopes in the mountain region have produced enough cut grass to feed 5 cows per acre.

4. Intensive management practices have been devised for growing Arabica coffee in full sunlight to yield over a ton of market coffee per acre.

5. Through the use of a kudzu-molasses grass mixture for strip cropping and rotation, a method has been devised for growing bananas on steep slopes with excellent erosion control.

Infiltration Changes Resulting from Forest Protection and Management

KENNETH J. SEIGWORTH AND EARL F. OLSON

In what was formerly forested eastern North America it is inevitable that abandoned agricultural lands (when left in a natural state) will revert to forest-type cover. However, certain successional trends can be manipulated by silvicultural treatments so that there are improvements in rainfall-infiltration rates and surface-water flows. Studies on some successional changes on several watersheds in Tennessee and North Carolina are briefly described, along with description of a system of classifying infiltration. One can raise such questions as: Are intensive soil microbiological studies being made? If not, is this an indication of a weakness in American watershed research?

IT IS NOW a generally accepted thesis that vegetal cover and its management significantly affect rainfall infiltration and surface water flow. Unfortunately, there are still too few recorded examples of how fast improvements can be brought about in infiltration rates. The 2,300-acre Norris municipal watershed (city of Norris, Tennessee) offers such an example. Here substantial improvement has been achieved in a relatively short time through modest forestry methods.

In the 20-year period 1934-1954, the fair and good infiltration classes of the total area have increased from 47 percent to 78 percent. A further increase to 94 percent is expected during the next 20 years, assuming continued modest protection and management. If the area gets a high level of silvicultural treatment—and that seems probable—the poor class can be virtually eliminated.

Here is a description of the area and an account of how the changes were brought about and measured.

The watershed is located in the steep hills of Anderson County in east Tennessee—about two miles from TVA's Norris Dam. Elevations range from 900 to 1,460 feet above sea level. About 1,850 acres were acquired by the city of Norris to insure and protect its spring water supply; an adjacent 453 acres is under long-term lease. With the exception of about 20 acres in two other ownerships, the city manages the complete watershed unit. Fairly complete land use and management records are available back to 1934. In addition, the area has been under close observation by a number of local foresters.

The watershed soils are principally of the Fullerton and Clarksville series, both underlain by heavy clay. They are mostly of the steep or hilly phase and renowned for their chertiness rather than for fertility or ease of farming. About 15 percent of the soil is Claiborne silt loam and five percent Greendale silt loam. These two associations occur in patches of one to 10 acres. There are few places where the limestone bed rock is exposed; generally it lies five to 50 feet below the surface.

The original forest was mainly oak, hickory, and yellow poplar, with a scattering of shortleaf and a few white pines. Though not a good farming area, some 25 to 30 families had settled in the watershed by 1900 and were attempting to farm and graze it. By 1934, this number had declined to about 15 and much of the 750 acres that had been cleared had reverted to forest.

TVA acquired the entire area in 1934 in connection with construction of Norris Dam and reservoir. The town of Norris, built nearby to house construction workers, pumped its water from a spring within the watershed.

In brief, this was the situation at that time: roughly 500 acres of mature or overmature, unburned, and only lightly grazed forest (this portion had long been under one ownership); 500 acres of recently abandoned cropland and unimproved pasture; 1,300 acres of heavily grazed second growth forest, 10 to 50 years of age. Frequent burning of woods and fields had been customary. Many of the fields had gullies; sheet erosion was general.

During the next 20 years under TVA ownership, forestry activities included:

1. *Fire protection:* So far as is known, only about two acres have burned over since 1934.
2. *Grazing control:* Effective control began in 1934. Grazing is now completely eliminated.
3. *Reforestation:* During the Civilian Conservation Corps era, approximately 300 acres of old fields were planted. About 100 acres of old fields have reforested naturally.
4. *Timber cutting:* Relatively light selection timber harvests of mature and insect-infested pine and lower quality 10 to 16-inch hardwoods have been made on about 450 acres of the older forests.

In 1948, the town was sold to private interests. It was incorporated a year later. In 1954, it acquired the watershed through transfer and immediately entered into an

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agreement with TVA's Division of Forestry and the Tennessee Department of Conservation to develop and use the area as a demonstration of multiple-use forest management, including public recreation, watershed protection, and timber production.

The first step was a forest inventory based on 252 sample plots each one-fifth acre in size. This inventory included the unique feature of classifying the forest land on each plot according to its capacity for infiltrating rainfall into the soil—*present, 20 years before,* and *potential.*[1] The classification system was first developed and used by TVA in its upper French Broad River (western North Carolina) flood control study in 1941. It is based on data collected by the Southeastern Forest Experiment Station at Bent Creek near Asheville, North Carolina, and by the Virginia Agricultural Experiment Station on watersheds on the Virginia Polytechnic Institute Farm. After the French Broad River study, it was used in a number of other areas in the Tennessee Valley. The four indexes or classes recognized and the criteria for them are shown in Table 1.

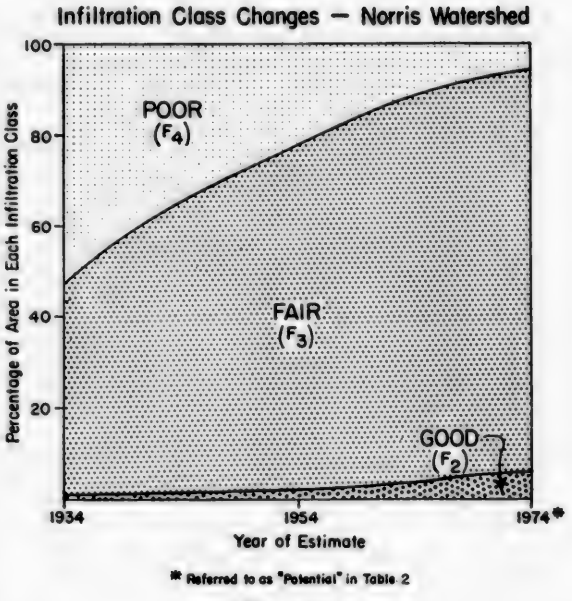

Figure 1.

TABLE 1. Infiltration Class Definitions. Norris Watershed.

	Excellent F_1	Good F_2	Fair F_3	Poor F_4
Canopy	80% or more	60 to 80%	25 to 60%	Less than 25%
Litter	3" min. depth, covering at least 90% ground surface	2"-3" deep, covering at least 90% ground surface	1"-2" deep, covering at least 80% ground surface	Generally very thin, covering less than 75% ground surface
A_1 horizon	4" min. depth	2" min. depth	1"-2" min. depth	Less than 1" deep
Soil	2' min. depth	1½' to 2' min. depth	1' to 1½' min. depth	Not more than 12" deep
Slope	No limitation	No limitation	No limitation	No limitation
Exposure	Generally north, east, or NW	Generally north, east, or NW	No limitation	No limitation
Fire damage	None in recent years	None in recent years	None in recent years	Often or recently burned
Grazing	None	None	None	Generally grazed

Careful observations of all eight elements that determine infiltration classification were made on each sample plot at the time of inventory. Taking note of ecological characteristics and trends, the examiners forecast the potential for each plot under continued good management. They also checked their observations of present ground conditions against excellent 1935 aerial photographs (and their own intimate knowledge of local ecology). In this way they reconstructed conditions as they existed 20 years ago. The plots were classified for three different points in time. Results of the infiltration class determination are listed in Table 2 and shown graphically in Figure 1. Figures 2 and 3 show certain discernible conditions existing in 1935 and 1948.

Significant and rapid changes occurred between 1934 and 1954 in canopy, litter, fire damage, and grazing, thus raising 30 percent of the area from the poor to the fair infiltration classification. As for the future, little of the area is expected to make the excellent class because of the difficulty of developing the needed four inches of A_1 soil horizon in this soil, forest, and rainfall situation.

[1] Defined as probable situation in next 20 years, assuming continued excellent protection and a modest level of silviculture.

TABLE 2. Number of Plots and Percentage by Infiltration Class. Norris Watershed.

Infiltration Class	1934 No. of Plots	1934 Percent of Plots	1954 No. of Plots	1954 Percent of Plots	Potential No. of Plots	Potential Percent of Plots
1 Excellent	—	—	—	—	—	—
2 Good	3	1	4	2	16	6
3 Fair	115	46	192	76	222	88
4 Poor	134	53	56	22	14	6
Total	252	100	252	100	252	100

However, more intensive silviculture than now contemplated, including interplanting of pine, might move five to 10 percent more into the excellent class. An almost 100 percent increase in the fair class and virtual elimination of the poor class is being achieved with modest effort. This is considered well worthwhile to a growing city.

Weir measurements over 21 years on another watershed, only 10 miles from Norris, also offer clear evidence that land cover improvement is significant and worth working for. The 1,700-acre White Hollow experimental watershed is almost identical to Norris in forests, soils, topography, history of land use, management, and protection. In the period 1935 to 1949, summer storm flow peaks were reduced five to 27 percent, surface runoff time increased as much as 500 percent, and sedimentation decreased 93 percent.

2/

1935

These TVA aerial photographs show certain changes that occurred in thirteen years on the Norris municipal watershed.

3/

1948

The large open fields were planted to trees; smaller openings reforested naturally.

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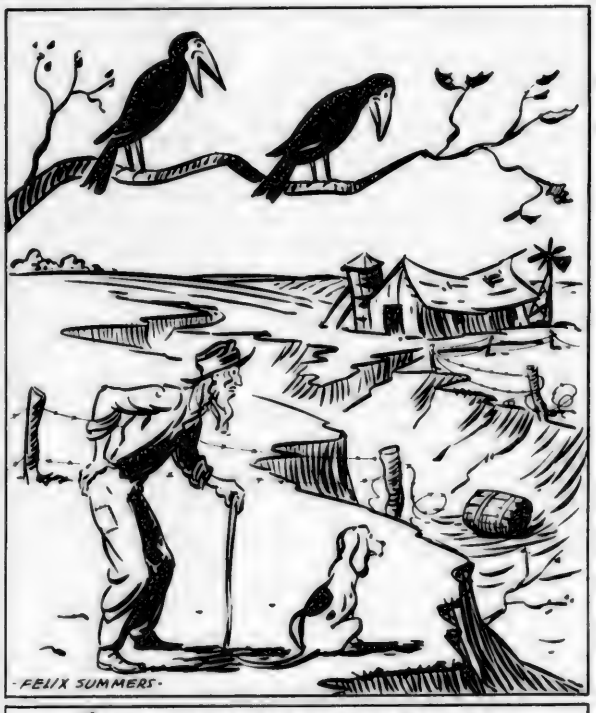


"POOR OLD FELLOW, HE OUTLIVED HIS FARM."

Comparative results observed on the much larger (103,000 acres) and quite dissimila- Ivy River watershed in western North Carolina add proof of the value of good management.

Here elevations range from 2,000 to 6,000 feet. Soils originated from crystalline siliceous rocks. Many of them are relatively fertile. Approximately 63,000 acres are forested. Timber types range from Virginia pine and mixed hardwoods to hemlock and red spruce. About 12,500 acres are in the Pisgah National Forest. Private holdings include 31,000 acres in relativly large tracts and 20,000 acres in small typical farm woodlands.

Using the same infiltration criteria as at Norris, these woodlands were mapped in 1941 and rechecked at the end of 1950. The entire watershed received good fire protection and the burn was low during the nine-year period.

Grazing and management practices, however, were not uniform over the three types of ownership and changes in infiltration classes reflected these differences directly. On the larger private ownerships, grazing was general and timber was harvested without much regard for good cutting standards. On the farm woodlands, there were more fences and fewer cattle in the woods; timber harvesting tended to be selective. On the national forest, grazing was eliminated and timber cutting was governed by high silvicultural standards.

Here is what happened on infiltration: on the poorest managed woodlands, there was a 5 percent increase in the good and excellent classes. On the somewhat better managed farm woods, the increase was 24 percent. *But on the well-managed Pisgah National Forest, there was a 49 percent increase in good and excellent classes.*

This system of infiltration classification has not been refined or calibrated to the extent desired. Foresters and hydrologic engineers in the Tennessee Valley believe that the various classes indicate relative quantitative differences rather accurately and that a finer degree of calibration can be developed for various subregions of the area.

Don't forget to write down these dates...

Soil Conservation Society of America, Annual Convention, October 19-22, 1958, in Asheville, North Carolina. The 1959 meeting is scheduled for Rapid City, South Dakota.

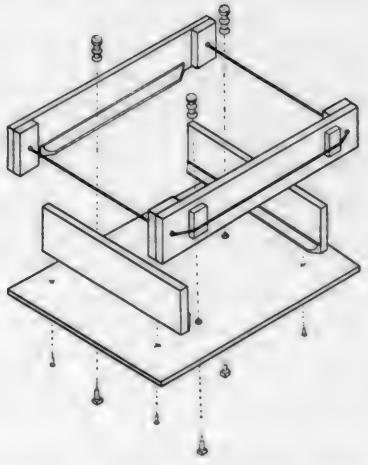
Improved Rain Gage Supports

J. L. THAMES AND S. J. URSIC

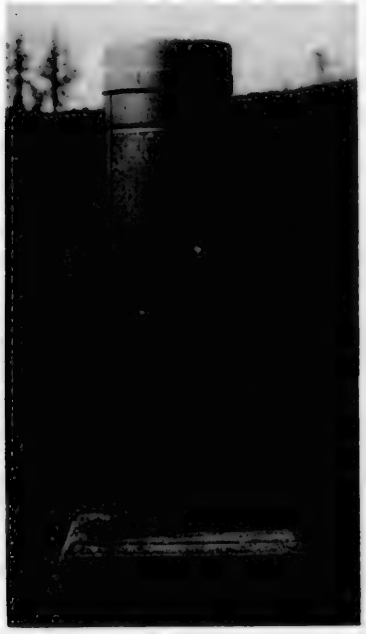
A LOW-COST concrete standard rain gage support, designed and constructed at the Tallahatchie Research Center of the Southern Forest Experiment Station, is illustrated in figure 1. This support is designed for the newer metal stands, which are available from most manufacturers of climatological equipment. It is stable, durable, and easily moved to new locations. A standard gage mounted on this support can be quickly installed, either horizontally or oriented with the slope.

The form for the concrete support (figure 2) is made up of a small sheet of ¼-inch plywood and scraps of 3-inch lumber. The molding strips give the block rounded edges, which look neater and are less likely to chip than square edges. A wire stretched around the form and through two of the sides holds the form together and facilitates removing the finished support. Four small movable blocks, used as wedges, keep the wire taut. Expansion shields for ¼-inch lag bolts are set in the form at the spacing required for the type of stand being used.

Use of pre-mixed concrete or mortar speeds construction. Coat hangers or pieces of wire can be used to reinforce the concrete. After the concrete has set, the form is inverted, the block-wedges and lag bolts are removed, and the form is lifted from the completed support. (The form should be heavily oiled before using.) The finished support is approximately 16 x 16 x 3 inches and weighs about 50 pounds.



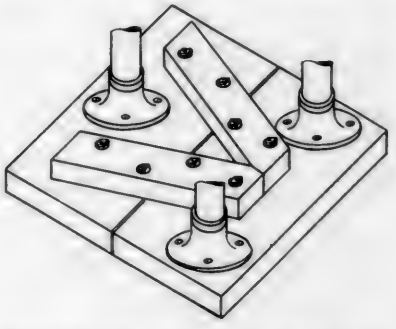
Form for concrete rain gage support.



The Tallahatchie rain gage support with gage mounted.

The metal stand mounted on the concrete base raises the bottom of the overflow can approximately six inches above the ground surface. While the standard Weather Bureau wooden stand raises the bottom of the gage 14 to 16 inches above the ground, the discrepancy is not believed to be objectionable.

An improved support for recording rain gages was also designed. The recorders are mounted on 2-inch stock as shown in figure 3. Three flanges are fastened to the 2-inch stock, and 3½-foot lengths of galvanized 1¼-inch pipe are attached. The pipes are then set in auger holes at the desired depth. The support is rigid and permanent, yet can be readily jacked out of the soil and dismantled for transport or storage.



Support for a recording gage.

J. L. Thames and S. J. Ursic are members of the Tallahatchie Research Center, which is maintained at Oxford, Mississippi, by the Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture.

Some Aspects of Land and Water Use In A Metropolitan Sector

Nationally and internationally the Forest Preserve of Cook County, Illinois, is admired and complimented. The pressures on this preserve of 42,000 acres are tremendous and almost ceaseless. There are those who would see it used for other than its stated purposes. But the board of commissioners and staff have, since its beginnings in 1915, come to realize that "each inch of forest preserve land in Cook County each day becomes more valuable to the common weal. They must be held and every loosening of policy is a precedent which endangers the whole."

IT IS NOT INTENDED here to present a "success story" or a history of the preserve. (Historical details, annual reports and other printed materials can be obtained by writing to the preserve offices at 536 North Harlem Avenue, Cummings Square, River Forest, Illinois.) Rather, we wish to describe briefly some interesting aspects of land and water use in the midst of one of the largest metropolitan sectors of the United States.*

Direction of the preserve program and development is vested in a board of commissioners. This board is empowered *"to acquire . . . and hold lands . . . containing one or more natural forests or lands connecting such forests or parts thereof, for the purpose of protecting and preserving the flora, fauna and scenic beauties with such district, and to restore, restock, protect and preserve the natural forests and said lands together with their flora and fauna, as nearly as may be, in their natural state and condition, for the purpose of the education, pleasure, and recreation of the public."*

Pressures . . .

The board has resisted firmly frequent formal attempts by the federal, state and local governments and organizations to secure preserve lands. (The pressures are not as long-standing as those which have been faced by another metropolitan "green area," Central Park in New York City. It has been estimated that if all the proposals for extraneous use of Central Park had been approved, these developments now would be three layers deep with buildings.)

Because the "line has been held," the Forest Preserve District now represents a rich and remarkable heritage of naturalness that is enjoyed annually by well over 13 million visitors, and it is not the purpose to increase the use of the holdings. Rather, in the words of the Conservation Department of the District, the purpose is to "improve the *quality* of use." It is recognized that "the only permanent safeguard for these forests and recreational areas is an informed public."

*Prepared by D. E. Wade, editor.

Its Conservation Department . . .

This department, well correlated with the others, is attempting to meet outdoor recreative and educative needs of some 4½ million people in Cook County and Chicago.

High on its list of problems is that of developing ways and means by which people can be taught to appreciate and understand what is, and rightfully, their own. And, always underscoring each problem is that driving punchline, "improve the quality of use."

To push ahead this function, major emphasis has been placed by the Conservation Department staff upon educational programs conducted in cooperation with the public and parochial schools of Chicago and Cook County.

There has been a good measure of success in this approach. Each of the school systems has appointed an outdoor education committee and, as a result, many workshops (some lasting 10 days) have been held for teachers each year. It is anticipated that teacher-training will become a major activity of the department.

It has been recognized by the leaders in the preserve district and the educators that if outdoor education and conservation education are to be successful they must stem from the curricula and efforts of the schools. To forward this, meetings with county and city superintendents of education have been held for unified consideration of outdoor education.

A Program of Education

There are many other kinds of educational efforts under way. A quick rundown reveals that real progress has been made not only for children and teachers, but for adults. Efforts have centered around such devices as the "Little Red Schoolhouse Nature Center," where "ecologic" exhibit motifs change with the seasons; self-guiding nature trails (many of which teach some basic natural history lessons primary to an understanding of conservation); folders and maps (ultimately to cover all nine divisions

of the district); fish management (*for fishing*); improvement of existing water areas and establishment of new; one-day field trips for teachers; school camping; summer schools for college credit; lectures to schools; and classroom field trips.

Other devices and methods include: training courses for youth group leaders; day camps (since 1948 with 61 day camps and 20,000 child-days, this has increased to 237 camps with over 40,000 child-days during 1956); day camps by the Chicago school social centers; general fish and wildlife management; and nature bulletins.

This wide-ranging program has paid off in bringing to literally millions of city and urban dwellers a more intimate understanding of nature and problems of soil and water conservation.

The leaders of the Conservation Department of the district—Roland Eisenbeis, superintendent of conservation; Roberts Mann, conservation editor; and David H. Thompson, senior naturalist—have been most generous in sharing their know-how and enthusiasm.

A Bulletin Each Week

Their writings, especially as reflected in a weekly one-page nature bulletin (started February 1, 1945), has probably introduced more conservation than anyone dreams of. These bulletins are issued during the school year.

About 19,000 elementary grade teachers and biology teachers in all schools of Chicago and Cook County receive a copy. In some cases, stencils are sent to schools for additional duplicating. A restricted mailing list of 1,300 gives the bulletin further distribution and additional duplicating in other areas of the country.

A project is now under way to publish all the back issues of the bulletin, grouped into 13 categories, for sale as a series of inexpensive booklets.

We Move Toward a Viewpoint

"Dynamic and refreshing." Are we willing to concede that this describes the program of the Forest Preserve District of Cook County, Illinois? Are we willing to concede that its program is giving opportunity to millions of metropolitan and urban dwellers to understand at first-hand many problems of resources and their use? And, even though we might be occupied by "economic" concepts, have we caught a glimmering of the very real and basic importance of *preserving in naturalness* some of the land and water and biological heritage of America?

If we are in the affirmative and can visualize re-creative and educative values, then we are ready for another final question: What must be done to get some of the concepts and program (as demonstrated in Cook County) incorporated into, say, the small watershed program?*

**An excellent exposition on this question is "The Place of Parks and Recreation in Our New Programs for Watershed Conservation" by Howard Zahniser. Transactions of the Nineteenth North American Wildlife Conference. 1954. Pages 64-69.*

Tribute to Past Editors

ALVIN F. BULL has served as acting editor of the JOURNAL OF SOIL AND WATER CONSERVATION, starting with the September 1956 issue and completing the September 1957 issue—more than a year of service.

Alvin F. Bull

"Al", like the previous editor, Walter C. Gumbel, was holding down a regular full-time position. The JOURNAL had to be worked on in spare time. "Walt" had served from Vol. 1, No. 1, September 1946 through Vol. 11, No. 4, July, 1956. Throughout their editorship these two men maintained high standards for the JOURNAL and improved steadily the format.

An editorship is somewhat like the old-fashioned sand timepiece. Materials pour through onto the editorial desk and there is a time element. But here we must drop the analogy. By the time the JOURNAL has been made up, printed and mailed, a great deal of filtering and refinement has taken place.

Unless one has engaged with the production of a journal —especially one going to a readership made up largely of professionals and semi-professionals, it is difficult to realize the work involved. And, the editorial staff is very much bound to materials available, sometimes scraping around on the bottom of the manuscript barrel.

W. C. Gumbel

So, "thank you: Al Bull, Mrs. A. F. "Joyce" Bull, President J. S. Russell, Executive Secretary Wayne Pritchard, Walt Gumbel, Mrs. Walter C. "Helen" Gumbel, Elmer Sauer and the rest of the editorial board, fine craftsmen at our printers (Wallace-Homestead Company), Robert H. Lyon of Des Moines, and Pauline and Sondra at the *Society's* national office." —*Editor.*

"Literature arrests the rapid flow of experience, holds it up for contemplation and understanding. Literature enables one to share the experience of men of all ages. Men who have been confronted with human problems and conditions of life common to men." When more publications on ecology appear, and when more publications on applied ecology (management) appear, then men will become exposed to the living-resources' background of the drama of human life. Is this background being pushed out of consciousness by our present urban culture?

ATLAS OF THE PACIFIC NORTHWEST. *Edited by* RICHARD M. HIGHSMITH, JR. *Oregon State College, Corvallis, Oregon. 140 pages, 72 maps. 1957. (Second Edition.) $3.50.*

The Department of Natural Resources of Oregon State College has produced a truly remarkable atlas that could well serve as a pattern for similar works on other regions of the United States.

Prepared with the cooperation of numerous departments of the college, it contains contributions by faculty specialists from many fields of the physical, biological and social sciences.

A wealth of material on the resources, industries and economies of the states of Oregon, Washington, Idaho, and the mountain counties of western Montana is presented in detailed maps and summary chapters. Excellent cartographic techniques in black and white have produced 72 maps that are detailed, uncluttered and easily read. Where necessary for clarity of presentation the maps are double-page in size. Where fewer details are shown, or where the material lends itself to less space, half-page maps are used.

Introductory chapters give a general view of the region and a historical summary of its settlement. These are followed by treatments of the physical basis of the area's resources including landforms, climate, water, forests and grasslands, with double-page maps showing types and distributions. Perhaps the outstanding plate in the atlas is the physiographic map by Erwin Raisz of Harvard University showing the landforms in minute detail by a pictorial technique that seldom has been equaled. Climatic data are shown by graphs superimposed on maps and in tabular form, while water resources maps show stream flow and power potentials. The section on soils includes maps of soil zones and land-use capability. Forest resource maps give the generalized forest types of the Pacific Northwest and summarize the condition of the forest lands today from the standpoint of commercial potential. Range lands receive similar treatment. Throughout this section on basic resources the authors emphasize proper management and wise use.

Agriculture receives a thorough treatment with maps of irrigated and non-irrigated croplands and generalized types of farming. These generalized agricultural maps are followed by 20 half-page dot maps showing the distribution of individual crops and livestock.

Other chapters cover fishing resources, minerals, electric power facilities, transportation networks, industry, commerce, population and urban centers.

It would be difficult to imagine a more thorough treatment of an area within the space allotted and in a publication at this price. This atlas should find a ready place on the reference shelf of anyone interested in our country's natural resources. In the absence of a truly national atlas of the United States, other regional atlases of this high caliber would be a valuable contribution to the knowledge and appreciation of our resource base.

—WALLACE E. AKIN, *Des Moines, Iowa.*

LIBERTY HYDE BAILEY: An Informal Biography. *By* PHILIP DORF. *Cornell University Press, Ithaca, New York. 259 pages, appendix, notes, bibliography, one illustration, index. 1956. $3.50.*

This is a biography of one of America's great agriculturists, who was also a foremost botanist and college administrator. Easy-flowing and readable, it shows the personality and character of a man whose ideals and accomplishments have been a great inspiration to many.

Mr. Dorf ably conducts us through Dr. Bailey's boyhood days in Michigan; through his years as college professor and dean; and on through his years of "retirement" that were devoted to work and mankind.

A great deal of the effort in establishing the New York State College of Agriculture at Cornell University was

Bailey's. He was devoted to the rural people, and in his capacity as dean, the institution and its work were dedicated to serve rural New York.

Dean Bailey formulated certain basic principles for the successors of those who founded the institution: "This College of Agriculture was not established to serve or magnify Cornell University. It belongs to the people of the state. . . . The farmers of the state have secured it. . . . Their influence has placed it here. They will keep it close to the ground. . . . If there is any man standing on the land, unattached, uncontrolled, who feels that he has a disadvantage and a problem, this College of Agriculture stands for that man."

Stories, anecdotes and actual conversations in which Liberty Hyde Bailey had taken part, are woven into the story of his life. The reader is made to feel that he is taking part in the experiences.

This book is rewarding. It would appeal to people in many walks of life. Conservationists should be interested, since Dr. Bailey was ever mindful that rural economy—indeed, the economy of the country as a whole—depends on soil resources and careful maintenance.

—RALPH WORK, *Fonda, New York.*

CONSERVING AMERICAN RESOURCES. By RUBEN L. PARSON. *Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 550 pages, illustrated, references cited, teaching aids, selected bibliography, indexed. 1956. $8.65.*

Since the publication of the 1930 edition of **Conservation of Our Natural Resources** by Van Hise and Loomis Havemeyer, there have been well over a dozen American textbooks on conservation. This reviewer has examined most, and it is his opinion that Parson has come up with one of the best. Dr. Ruben Parson is professor and chairman of the Department of Geography at East Tennessee State College.

By fall of 1957, at least 100 colleges and universities had adopted **Conserving American Resources** as a text or primary reading for courses in conservation of resources.

It has a lively treatment. There is a generous use of thought-provoking illustrations — line drawings, photographs, charts, maps and tables. Boldface marginal subheads on most pages furnish a stimulating outline and review of content. These marginal "notes" might easily be accepted as guidelines for various conservation agencies and organizations.

The materials included in the book have been tested with teachers-in-training and teachers' workshop groups in Tennessee. "Rube" Parson is not a "behind-the-podium" professor. He has put in at least 20 years as a vigorous leader of field trips and actual experiences in the field for his students and teachers. The references cited in the book attest to Parson's prodigious command of the recent literature.

An outstanding feature of **Conserving American Resources** is the development of chapters on specific resources from the logical and basic concept of "unity of natural environment." Such unity "demands a unified approach to conservation."

Parson, in contrast to many others who have prepared conservation textbooks, gives natural areas and wilderness a strong position in the total organization of resource management. He points out our belated recognition of these irreplacable and fundamental aspects of the total landscape.

In spite of his use of bold broad strokes in introducing a substantial number of basic principles and concepts involving resources, Parson manages to raise many questions. The reader is led and, one might say, forced to take a forward look into the relationships of people and resources. This is good teaching.

Conserving American Resources is enough of an exciting book on resource management to deserve widespread circulation worldwide. It is this reviewer's conviction that it should soon be reprinted in an inexpensive paperbacked edition, given an "eye-catching" cover, placed on magazine and book counters in all sorts of stores, and pushed concertedly by all conservation organizations.—D. E. WADE, *Des Moines, Iowa.*

[**Editor's Note:** The above review should have been prepared by another reviewer, but time did not permit. However, you are invited to submit to the editorial office critical commentaries on or relative to the book, **Conserving American Resources.**

It is not promised that all or any of the commentaries received can be published. Commentaries can be prepared by individuals or groups.]

DOCUMENTS ON THE USE AND CONTROL OF THE WATERS OF INTERSTATE AND INTERNATIONAL STREAMS: COMPACTS, TREATIES, AND ADJUDICATIONS. *Edited by* T. RICHARD WITMER, *Department of the Interior, Washington, D. C. 760 pages. (Sold by Superintendent of Documents, Washington 25, D. C. $2.)*

This is the first published complete collection of compacts, treaties and decisions of the Supreme Court in the field of interstate and international water rights.

Apportionment of the use of water, pollution control and flood control are the subjects of the agreements and decisions included.

The volume contains the complete texts of 20 interstate compacts now in force, 15 compacts that have not been fully perfected by state ratification and congres-

sional consent, seven treaties with Canada and Mexico, and 22 Supreme Court decisions.

Our earliest water treaties, apart from those dealing with navigation, were entered into with Mexico in 1906 and with Canada in 1909. Our first interstate compacts covered the Colorado and LaPlata Rivers in 1922.

Thus we see that treaties and compacts dealing with water are a Twentieth Century phenomenon.—D.E.W.

THE FOREST IS THE FUTURE. *By* JONATHAN DANIELS. *International Paper Company, New York. 66 pages, illustrated. 1957.*

The author of this "company" publication is a southerner. He looks at the revolution which has been taking place throughout the South. A revolution marked by paper and pulp mills and fast-growing trees. Here is a land-use turn that can bear watching and careful study. Inherent within the changes are problems of economics, sociology, politics and biology—all tied to tree growing and forest protection.

These are all discussed by the author. In the matter of over-all land and water use, will the pulp industry be a blessing or curse in the southern states? Conservation education, founded upon ecological concepts, seems to be needed to help answer this question.

Another need is that of being able to discuss objectively the many problems that accompany strong, single-purpose land-use operations. This publication opens the door. The makeup and illustrations of the book are excellent.—D.E.W.

Literature Briefs

WATER FACTS

The U. S. Soil Conservation Service has released an interesting and useful 12-page, four- by nine-inch, pamphlet, entitled **WATER FACTS.** It does a splendid job of condensing and summarizing a complexity of information regarding various quantities of water involved in sources, supply, needs, uses, losses and floods.

For the most part it is a straight-forward treatment of facts, for the most part a good job. The only possible bit of propaganda noted—and the chief point of difference with which we take issue—is an implication that substantially more drainage of wetlands is needed — perhaps 67 million acres.

We do not question that drainage would improve these lands for production of conventional farm crops. But, in this day when crop surpluses are such a national burden—and when we are confronted with expanding needs for fish and wildlife (other kinds of farm crops) produced by wetlands to support mushrooming outdoor recreation needs — further encouragement of drainage seems misguided to us.

With a further reservation, that recreational fishing and hunting are given only casual recognition, the pamphlet looks like a significant contribution to national understanding of water problems. To get copies, write to D. Harper Simms, Director of S.C.S.'s Division of Information, Department of Agriculture, Washington 25, D. C., and ask for pamphlet PA-337.—*From* **Sport Fishing Institute Bulletin,** *No. 71, October, 1957.*

Transactions Available

Transactions of the Fourth National Watershed Congress, held September 23-25, 1957, in Atlanta, Georgia, can be obtained at $3 per copy from John H. Jones, P.O. Box 1062, Fairmont, West Virginia.

ECONOMIC PROBLEMS OF NATURAL RESOURCE USE. By William H. Stead. Joint Council on Economic Education, 2 West 46th Street, New York 36, New York. 64 pages, illustrated with 11 graphic charts, including a two-page center spread, "Teacher's Guide to Resource Use" and a bibliography. A "study guide" ("Thinking and Talking It Over") by George L. Fersh is incorporated throughout the booklet. 1957. $1.25.

Although designed for teachers and students in formal education, this booklet will find much use among lay and professional conservationists.

Rate of use and possible shortages of resources are discussed. Challenge to technology is presented as a many-sided and complicated affair. The economic problems and responsibilities of government, private business and individual citizen are discussed.

The reader can test his knowledge of subject matter and improve his perspective by making careful use of the "Thinking and Talking It Over" portions of each of the five chapters.

THE CONSERVATION DIRECTORY. A listing of organizations and officials concerned with conservation is now available in a 1957 edition from the National Wildlife Federation, 232 Carroll Street N.W., Washington 12, D. C. 102 pages. Price 50 cents.

WOOD / COLORS AND KIND. U. S. Department of Agriculture, Forest Service, Agricultural Handbook No. 101. 36 pages. October, 1956. U. S. Superintendent of Documents, Washington 25, D. C. 50 cents.

Illustrated by full-color photographs helpful for those wanting to identify various woods. Other facts are given about 32 American woods and trees. Three-page glossary.

WATER FOR THE MILLIONS. By Wallace I. Hutchinson. U. S. Department of Agriculture, Forest Service, California Region, San Francisco, California. 84 pages, richly illustrated. 1956.

A well-prepared publication on the water situation in southern California.

This booklet popularizes findings gathered from a survey of the water situation of a heavily populated sector of the far West.

It is interesting to note that the Pacific Ocean has been termed "the last water hole for southern California."

FORESTRY ABSTRACTS covers literature world-wide and publishes about 4,500 abstracts each year. Annual subscription is $9.40 U.S.A. or Canada. Post free. Orders should be sent to Central Sales Branch, Commonwealth Agricultural Bureaux, Farnham Royal, Buckinghamshire, England.

UNASYLVA, Volume 11, Number 3, 1957, pages 103-9, carries an article on "The Use of Aerial Photographs in Tropical Forests," by D. A. Francis.

BY WHICH WE LIVE. By Ernest Swift. National Wildlife Federation, 232 Carroll Street N.W., Washington 12, D. C. 38 pages. 1957. 25 cents.

Swift, executive director of the National Wildlife Federation, has written a series of militant essays touching upon many controversial or neglected phases of conservation.

Whether or not the reader will agree with all of Swift's contentions, he will find that his essays are thought-provoking.

By Which We Live can well be the forerunner leading the way for objective research on various topics touched upon by the author.—D.E.W.

RONALD Books:

AMERICA'S NATURAL RESOURCES

Edited by a Committee Headed by CHARLES H. CALLISON, National Wildlife Federation

NEW, factual survey of America's natural resources, their conservation, and interdependence. In separate chapters experts treat each resource, its historical background and importance to man. Book details dangers to each resource; explains how it can be preserved and used most profitably. **"This excellent book . . . puts our natural resources in unified perspective."—*The Scientific Monthly.*** Edited for the Natural Resources Council of America. **$3.75**

Conservation Education in American Colleges

CHARLES E. LIVELY, University of Missouri; and JACK J. PREISS, Michigan State University

JUST OUT! A complete summary of the first national survey—sponsored by the Conservation Foundation—of the status of conservation teaching in our colleges and universities. Considering conservation as a social process, book clearly defines the tasks it must perform. Reviews the historical development of conservation education; the survey's objectives, methods, and major findings. Authors' recommendations included. **85 ills., tables. $5**

Irrigation Development and Public Water Policy

ROY E. HUFFMAN, Montana State College

THE ECONOMICS and social aspects of U.S. irrigated agriculture and public water policy. Includes sound and far-sighted irrigation policy on the local, regional, and national levels. **"Contains much forward thinking . . . useful to employees in public agencies concerned with land economics, agriculture, and conservation."—*Journal of Soil and Water Conservation.* 19 ills., tables. $6.50**

CONSERVATION LAW AND ADMINISTRATION

WILLIAM F. SCHULZ, Jr., University of Pittsburgh School of Law

COMPREHENSIVE analysis of a state's conservation laws and the administration of its renewable natural resources. Book presents a digest of Pennsylvania's law and pertinent federal statutes on resource use. Includes a Model Conservation Administration Act, other 'blueprint' information. **"A highly important and significant study of the whole problem."—*Soil Science.*** Sponsored by the Conservation Foundation. **34 ills., tables. $10**

Order books from:

The Ronald Press Company
15 E. 26th Street, New York 10

OUR VANISHING SHORELINE / THE SHORELINE / THE SURVEY / THE AREAS. By the U. S. Department of Interior, National Park Service. 36 pages, illustrated, list of areas along the Atlantic Ocean and the Gulf of Mexico selected by the survey as being especially suited to public use. Not dated [1956]. Price not listed. Presumably can be obtained from the National Park Service, Washington 25, D. C.

This is an exceedingly well-prepared report in subject matter, typography, layout and use of color.

In the field of land and water use it is an important and timely report. Coastal lands accessible to the public in general are already scarce. Coastal lands in relatively undisturbed condition are even scarcer and expensive.

Coastal land use and development has now entered a critical stage in the United States.

It would seem that some "principles" of land and water use need to be developed and directed toward those responsible for "commercialized developments" along coasts and toward those who would like to see a few unspoiled coastal spots left along the Atlantic and Gulf shores.

For instance, along the Gulf coast of Florida, certain "developments" now under way during a dry period with water tables low, may be afflicted with too much water during wet periods of high water tables.

Can **Our Vanishing Shoreline** be an object lesson in the lack of proper planning and proper action in land and water use?

—D.E.W.

A REPORT ON SPORT FISHING RESTORATION. Prepared by the U. S. FISH AND WILDLIFE SERVICE. *Publication financed by the Sport Fishing Institute. 28 pages, well illustrated, charts, tables, map and photographs. 1957. (Address requests for copies to Sport Fishing Institute, Bond Building, Washington 5, D. C. Price of single copies is not given.)*

Supplementary to this publication is another, **SPORT FISHING RESTORATION: STATISTICAL SUPPLEMENT.** U. S. Fish and Wildlife Service, Washington 25, D. C. 59 pages. 1957.

These two publications cover the Dingel-Johnson activities for the first five-year period, 1952-1956.

Angling is an acceptable recreation in multiple use of most water areas. Some exceptions are made, especially on municipal reservoirs, where fishermen and others have demonstrated poor manners, leaving all sorts of trash in and around water areas.

This reviewer raises the question, should professional workers in land and water use cultivate public sensitivity to land and water "ethics," including this seemingly trivial matter of rubbish?

Is it not true that individual sensitivity to small matters can be compounded into community action dealing with gross "rubbish" situations such as silt and pollutants?

Elementary teachers and parents use this progressive method of teaching, starting with the individual and his actions in an immediate situation and expanding to the larger community-important habits or actions.—D.E.W.

GULF OF MEXICO / ITS ORIGIN, WATERS, AND MARINE LIFE. Coordinated by Paul S. Galtsoff; many authors. Fisheries Bulletin 89, U. S. Fish and Wildlife Service. 604 pages, maps, references, index. 1954. For sale by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. $3.25.

Here is a fascinating volume summarizing in convenient form our present knowledge about the Gulf of Mexico.

Such a summary was needed in view of the large number of investigations being made. Information formerly scattered in thousands of technical publications, some of them rare, is now easily available. Here is an accumulation of *identification, life history* and *ecological* data.

Gulf of Mexico is directed toward improved management of segments of a vast area of water, islands and contiguous lands.

Specialists and others versed primarily in inland land and water features will gain in perspective by studying this volume, especially those parts that deal with formation of shorelines, deltas and sediments. There is a part on the "recovery of minerals from sea water."

Gulf of Mexico is a notable and important reference particularly for those devoted to better water and land use in the Gulf of Mexico sector.—D.E.W.

THE WATER RESOURCES COUNCIL. Undated [1957] brochure issued by the Water Resources Council, 22 East 60th Street, New York 22, New York.

Describes the council and its proposed program: water needs, stretching the available supply of water through cleaning up streams and more efficient use of water; watershed development; ground water recharge; conversion and distribution of water; and, creating a public awareness.

Council is made up of 20 national conservation organizations, with consulting and technical help from the Conservation Foundation, the Mellon Institute of Industrial Research, and the U. S. Public Health Service.

Although several of the representatives on the council of several constituent organizations are members of the *Soil Conservation Society of America,* this *Society* is not a member of the Water Council.

Begun in New York at the initiative of the American Water Works Association whose 17,000 members man the municipal water systems, the Water Resources Council was formed in Washington in 1956 principally via the efforts of the Water and Sewage Works Manufacturers Assocation, whose members were in a position to evaluate the operators' growing concern at the nation's rising water demands and falling water tables, and growing destruction of water through pollution.—D.E.W.

GRAZING AND FOREST ECONOMY. FAO Publication. In the United States can be obtained from the Columbia University Press, International Documents Service, 2960 Broadway, New York 27, New York. 162 pages, illustrated, English, French or Spanish editions. 1953. $2. [A monthly announcement of United Nations publications is available free from the Columbia University Press.]

Field Notes

Report on Scientific Manpower Commission

The *Soil Conservation Society of America*, through its representation in the Policy Committee for Scientific Agricultural Societies, has representation on the Scientific Manpower Commission. Because, in many respects, problems inherent to scientists can be better handled by an organization that represents all of science than by the individual efforts of individual societies, several specialized scientific societies joined together about four years ago to organize the Scientific Manpower Commission. The S.C.S.A. became a member two years ago.

The Scientific Manpower Commission, representing the 10 principal scientific groups in the United States, has completed its fourth year of activity representing more than 200,000 U. S. scientists in the fields of agriculture, astronomy, biology, geology, mathematics, physics, chemistry and psychology. It has been supported financially by the sponsoring societies and by generous contributions from industry.

The Scientific Manpower Commission works closely with the Engineering Manpower Commission. For example, the two organizations jointly publish the Engineering and Scientific Manpower Newsletter, an occasional publication that brings to its growing circle of readers current information on legislation, research studies, population trends, and other matters concerning the training and effective utilization of scientific and engineering talent.

The Commission has worked with professional organizations, schools, colleges, universities, and communities on the recruitment and training of teachers, scientists and engineers. Its members have participated in conferences and in action programs. With the Engineering Manpower Commission it has succeeded in alerting the Congress and a growing public audience to the gravity of the teacher shortage. The S.M.C. participated. in every hearing and supplied facts that guided Congress in providing a six-month training program for qualified scientists and engineers and in creating machinery for screening specialized personnel from the ready to the standby reserve.

From a service point of view, the Commission has supplied material that has been incorporated in scores of speeches, newspaper and magazine articles, and in other publications. Information contained in the EMC-SMS Newsletter, which reaches over 8,000 readers, has been widely quoted. Members of the Commission have taken active part in 50 manpower meetings, conferences and broadcasts. Two Commissioners serve on the Selective Service National Advisory Committee—one of them as its chairman. Two serve on the Committee on Specialized Personnel of the Office of Defense Mobilization.—C. L. W. SWANSON, *S.C.S.A. representative on S.M.C.*

Watershed Center in India

During 1956 the Forestry and Agricultural Divisions of FAO jointly started organizing a regional Development Center on Watershed Management. At the invitation of the Government of India, the center was held in the upper Damodar Valley at Hazaribagh, Birah, from February 18 to March 15, 1957.

Nine governments of the region nominated participants, comprising 11 foresters, nine agriculturists and one engineer, drawn from Australia, Burma, Ceylon, India, Indonesia, Japan, Pakistan, the Philippines and Thailand. Two special lecturers, **Herbert C. Storey,** Chief, Division of Watershed Management Research, U. S. Forest Service, and **John H. Wetzel,** Chief, Small Watersheds Planning Division, U. S. Soil Conservation Service, were brought to the center to present the basic material for the technical program. [Both of these men are members of the SCSA, Wetzel being a charter member.]

The program of the center was developed around the concept of land-use planning and management with small watersheds forming the units of management. While a general sketch plan for entire river basins is desirable detailed plans for action on improvement programs should be based on the small watershed units which make up the entire basin.

Lectures and discussions were held on the following general subjects as related to small watershed:

1. Basic concepts of the hydrology
2. Application of forestry techniques in control and the role of forestry in planning
3. Application of grazing management and revegetation techniques, the relationship of grazing to agriculture and forestry, and the role of grasslands in management planning
4. Soil conservation techniques in arable land management, the development of farm plans, and the application of improved land use and production practices which will assist in better soil conservation
5. Design and use of engineering structures in control and in improved farm, forest and grassland management
6. The overall planning of management projects and the education and extension activities which must be included in such planning.

The last week was given over to the actual planning of a small watershed. The participants were divided into teams of five and each team was assigned the task of developing a plan of improved land use and management, but each with a different set of objectives. For instance, one group was to develop a plan which would serve an irrigation project, another a plan which would give maximum sustained flow of clear water throughout the year; all plans, of course, including adequate soil conservation considerations.

Two of the major problems affecting watersheds in the Asia and Far East regions are shifting cultivation and grazing. These problems have social and political as well as technical implications. This emphasizes the need for including watershed management as a part of the forest policy of each country. Shifting cultivation will be made the subject of more intensive studies in the future.

The papers presented are to printed by the **Soil Conservation Society of India,** and will be available, in English, for general distribution. (Address: Hazaribagh, Bihar, India.) A report on the project is also being prepared by FAO. [From **Unasylva,** Volume 11, Number 3, 1957.]

Malabar Farm Research Center

Ollie Fink, editor of **Land and Water** (Friends of the Land, R.F.D. 3, Zanesville, Ohio), has announced that Malabar Farm has been acquired by Friends of the Land and will be operated as an experimental and educational venture. Malabar was owned by the late Louis Bromfield and made famous in Bromfield's books, **Pleasant Valley, Malabar Farm, Out of the Earth** and **From My Experience.** Each year at least 25,000 visitors are received at this internationally famous farm.

Salinity Survey in New Jersey

A cooperative ARS-SCS salinity survey, taking soil and water samples monthly for three to five years from six or more locations where brackish water is used for irrigation has been set up for Cumberland County in New Jersey. Presumably details can be obtained from SCS State Office, Box 670, New Brunswick, New Jersey.

Saline Water Conversion Symposium

Inquiries about abstracts and proceedings of the **Saline Water Conversion Symposium** held in Washington, D. C., November 4-6, 1957, should be addressed to the Division of Physical Sciences, National Academy of Sciences, 2101 Constitution Avenue N.W., Washington 25, D. C.

A preliminary program notice showed that papers were given covering distillation, membrane, solar and freezing processes and additional developments in saline water conversion.

This international meeting was under the sponsorship of the Office of Saline Water of the U. S. Department of Interior, and the National Academy of Sciences — National Research Council.

North American Wildlife Conference

The 23rd annual N.A.W.C. will be held in St. Louis, early in March, 1958.

Details of this well-attended conservation meeting can be obtained from the sponsors, Wildlife Management Institute, Wire Building, Washington 5, D. C.

J. S. Bali, Assistant Soil Conservation Officer (Engineering) of Soil Conservation Research Center, Dehra Dun, India, was welcomed to the national office by President J. S. Russell on July 2, 1957. Mr. Bali was touring the United States traveling under the auspices of the International Cooperation Administration. He is a graduate of Allahabad University. Mr. Bali is a member of the Soil Conservation Society of India.

(See photograph to the left.)

Irrigation Water Losses Reduced

"These are the principal reasons for lining irrigation canals: (1) seepage is prevented; (2) maintenance cost is greatly reduced; (3) operating waste is greatly reduced; (4) operating the system is easier and more economical; and (5) the weed problem is greatly reduced.

"When the surface canal is replaced by an underground pipeline, the following advantages accrue to the irrigator: (1) evaporation is prevented; (2) the weed and insect problem is eliminated; (3) no right-of-way is required for the buried pipeline —farming operations continue as if it were not there; and (4) pipelines can be designed and built to operate under pressure."

(Abstracted from "Concrete Pipe and Canal Linings," by Carl L. Welder. **Irrigation Engineering and Maintenance**, Volume VII, Number 3, March, 1957.)

Irrigated Sheep Pastures

During the past two years the Missouri Experiment Station, Columbia, Missouri, has carried on experiments with irrigation applied to sheep pastures.

Detailed results can be obtained from the station.

It has been suggested that similar tests be conducted on dry-lot feeding of sheep, with forage grown and harvested as needed from well-fertilized and irrigated fields.

Ground Water Legislation

Nebraska is shaping up legislation exercising controls on ground water supplies.

"No irrigation well, under one bill, could be drilled closer than 600 feet to an existing well except by special permit." A provision banning well-drilling within 300 feet of a property line was eliminated by the legislature's Public Works Committee.

"Another bill requires the registration of irrigation wells within the state."

Earthmoving . . .

A color and black-and-white picture story in the March **International Trail** magazine (published by International Harvester Company) effectively illustrates 1957 earthmoving. Almost overnight Hannibal, Ohio, became the center of a job involving earthmoving and truck equipment worth $2 million.

The job: move six million cubic yards of earth on 1,100 acres; pour 140,000 cubic yards of concrete; build 12.9 miles of roadway; erect 25,000 tons of steel, providing facilities for a permanent water supply of nine million gallons per day; and build a 700-house town-site.

Goal: scheduled for completion in 1958, is an aluminum plant with a calculated annual production of 180,000 tons.

Along the Wabash

A proposal is being made to canalize the Wabash River in Indiana from where it empties into the Ohio near Shawneetown to Lafayette, about 200 miles upstream. The purpose is for river transportation.

Claims have been put forth that the project would, when completed, cure the flood problems on tributaries, such as the Embarrass River.

According to a release in the October, 1957, **Natural Resources Remarks** of the Department of Natural Resources, 43 East Ohio Street, Chicago 11, Illinois, "It is a bit difficult to understand how . . . canalizing a stream to make it navigable" will cure flood problems. The engineers will have to provide for a minimum channel depth at all times, including drouth periods, to permit passage of loaded river barges.

Involved in the proposed project would be navigation dams and locks and large reservoirs on tributary streams to insure sufficient water to maintain minimum channel depths. "If this be the case, then certain lands could be permanently flooded."

Honors to Conservationists

In the 1956-57 year, 155 SCS employees received "Outstanding performance ratings." Twenty-eight state conservationists recommended employees for ratings. Twenty-six employees in area offices and 68 in work units received the high honors.

Notices of such honors are usually given good local press, radio and TV coverage, with notices going locally to Soil Conservation District Supervisors and other key groups, including Chambers of Commerce and industry.

States and P. L. 566

In the 1957 legislative year, 18 state legistures adopted 26 pieces of new or amendatory legislation to further local and state cooperation with the USDA on Public Law 566 activities on small watersheds.

During 1955, 1956 and 1957, 37 states passed 75 pieces of legislation relating to P. L. 566 work.

In nine states, SCDs now can exercise power of eminent domain, nine can levy taxes or assessments, 10 can borrow money, and four can issue bonds.

Main Street and Conservation

Farmers in the Pontotoc County, Oklahoma, Soil Conservation District suffered over a million dollar loss from floods and excessive rainfall in 1957. This is money that won't be spent on "Main Street" this year.

"Main Street" now is more awake to the urgent need for soil and water conservation.

How Important Is Dew?

Dew Research by the USDA at Coshocton, Ohio, indicates that dew may be an importance source of moisture for crops.

Dew accumulation in one year can total up to 10 inches of water in the Midwest, according to the tests, and in some years may provide up to 20 per cent of the water supply for crops.—**Agribusiness Outlook**, September, 1957.

We Are Getting Map-Minded

In March, 1957, the Geological Survey marked its 78th anniversary. By the end of fiscal 1956, the bureau had 18,000 different maps available in the national topographic map series. Approximately 3.3 million maps and map indexes were distributed during the year.

Maps and aerial photographs are basic tools in introducing people to land and water use problems.

Weed Control May Help Offset Loss of Waterfowl Habitat

By making some of the remaining wetlands capable of sustaining more migratory waterfowl, America may be able to offset some of the waterfowl habitat being lost by drainage and development.

One of the current efforts along this line is weed control research which the Bureau of Sport Fisheries and Wildlife, United States Fish and Wildlife Service, is conducting in cooperation with various states. The purpose of this research is to find ways of eliminating undesirable marsh plants and to substitute plants which will produce food for migratory waterfowl.

The project entails testing various new herbicides to discover those which will eliminate the noxious weeds without injuring wildlife values and without hampering planting programs. Not only is it necessary to know what to use, but information must be developed on when, how and under what conditions the selected herbicides should be used to give the best results.

Research to date indicates that effective killing of three of the worst pest-weeds—cattails, phragmites and needlerush—can be accomplished expeditiously. But, alligator weed, a fourth nonfood-producing plant, has thus far defied effective control by chemicals or otherwise. However, in some of the experiments conducted in North Carolina, promising leads have developed. Each one of these pest-weeds occupies hundreds of thousands of acres in certain sections of the country.

Two hundred experimental plots in Delaware, Maryland and North Carolina were recently inspected by technicians from nine states, three chemical companies and two federal agencies, who spent four days studying the techniques and the results.

Most of these test plots are small, averaging 1,000 square feet, but some were an acre or more in extent. The small plots are used to screen the various herbicides; promising formulations are then used on the larger plots.

Formerly there were 127 million acres of wetlands in the United States, but this amount has been cut to 75 million acres by drainage. About 9 million acres are considered good waterfowl habitat. Each year several hundred thousand additional acres of wetlands are converted to other use. The weed control experiments may point the way to convert hundreds of thousands of acres of waste marsh to duck and goose feeding areas.

Oil and Wildlife Lands

Oil and Gas Leasing on Wildlife Lands is the subject of proposed revised regulations.

Four separate classes of wildlife lands are recognized in the regulations. These include wildlife refuges, game ranges, Alaska wildlife areas, and federal-state cooperative lands.

A processed copy of the proposed regulations can be obtained from the Fish & Wildlife Service, Washington. The regulations were published in the **Federal Register**, as of October 7, 1957.

Howard F. Barrows

Barrows Retires from Austin-Western

Howard F. Barrows, advertising and sales promotion manager of Austin-Western, retired November 1. In 46 years of service, Howard has seen the progress made from early horse-drawn equipment to the present era of giant self-propelled specialized machinery.

He was a pioneer in using sound color films in advertising and promotion.

Long active in soil conservation circles, Barrows was named an honorary member of the *Soil Conservation Society of America* in 1953, and since 1956 has functioned as national treasurer of the *Society*, a post to which he was just re-elected for the 1957-58 term at the recent national convention in California.

He was the first chairman of the Northern Illinois Chapter of the *Society* and served as chairman of the Business and Organizational Relations Committee for several years.

Mr. Barrows and his wife, Edna, were married in 1912 and make their home at 104 North Park Avenue, Hinsdale, Illinois.

Falcon Lost, Falcon Found

Morlan W. Nelson, SCS Snow Surveyor, trains and flies falcons. He flew a falcon at the Pacific Grove convention. This flight was a first at these annual meetings. But the falcon took off for a place unknown to falconer Morley.

Two days later, **Doc Gaines** of Troy, New York, an SCSA member attending the California meeting, discovered the falcon high in a tree. Doc climbed the tree, recovered the bird, and sent it on back to Morley.

Morley did not learn who had done the good deed until **Executive Secretary Wayne Pritchard** wrote in answer to a request from Morley for information on the recovery.

Morley wrote Wayne that the people at the meeting were by far the most considerate he had ever encountered.

Below you see some of these considerate and keenly interested "people," and the falcon and Morley.

News Notes

PRESIDENT'S COLUMN

Since this job of writing the president's column is soon to be turned over to Russell Hill, this last attempt can be best directed to an appreciation of what officers of the *Society* and chapters and committee chairmen and members have contributed during 1957.

J. S. Russell

Just belonging to an organization isn't enough unless it really means something and the member contributes something to and gets something from such membership.

We've a long way to go to realize our potential, but if we can continue to improve the JOURNAL OF SOIL AND WATER CONSERVATION, to add net gains to our total membership again and work out some of our objectives for furthering the over-all cause of conservation—then 1958 can be an even better year.

Harold "Dutch" Rhodes, membership chairman, and his committee set some goals for new members and from October 1, 1956, to October 1, 1957, many of the states met or exceeded their quotas.

Membership work has been going on at a gratifying pace in states like Georgia, Mississippi, North Carolina, Indiana, North Dakota, Washington, Wyoming, to mention only a few, while Kansas, Michigan, California, Oklahoma, Iowa and Nebraska also have been on the move.

And "Dutch" is reminding folks that we have some time left in this calendar year to push the membership even higher than the 7,493 recorded on October 1.

When the council met in Monterey, California, in late August, it was decided that there are times when the *Society* should speak up. Much depends on the subject, of course, and we need to consider what the *Society* says and how it is said.

Suppose we were to agree that the only time an individual farm or ranch owner deserves assistance of any kind for conservation is on the basis of a goal or plan for the entire acreage. And suppose we were to agree that such assistance either at federal, state or local level be on the basis of progress toward this farm conservation goal, whether it be on the basis of cost-sharing by some government agency, credit or technical assistance. How would you state such a policy?

Or suppose we were to agree that in urban expansion, in diversion of land from agricultural to non-agricultural uses, including new highways, proper consideration should be given to the quality of land, its usefulness or particularly the effect on soil and water management and control. How would you state such a policy?

We are going to surrender productive land for highways in many an instance. That is inevitable. But can't we speak up for the highway folks to have a little more respect for land use?

These are only a couple of instances in which we have a chance to express our beliefs as conservationists as to what might be good public policy.

Write to me, Russell Hill or Wayne Pritchard on any ideas you may have as to what we as a *Society* should say and how.

Some of you may have noticed that as we acquired a new editor for the JOURNAL, we lost a member of the editorial board.

But replacing Douglas Wade on the editorial board and to finish his unexpired term is Walter Gumbel—and so it seems that we benefit all the way.

—J. S. RUSSELL, *President.*

Society Collecting Historical Material

The archives committee of the Soil Conservation Society of America is collecting information about the early history of the movement.

Dr. T. S. Buie of Columbia, S. C., chairman of the committee, states: "The committee is maintaining a record of *Society* history and activities but, in addition, has the opinion that much of the history of the soil conservation work started in the early 1930's will soon disappear. We believe that many members of the *Society* have in their possession or know the location of documents, speeches, booklets, photographs, and other similar material, that would be valuable to future conservationists.

"We further believe that steps should now be taken to preserve this material before it is destroyed. The *Soil Conservation Society of America*, nationally, is interested in securing only material of a national or regional interest. We suggest that local chapters within a state might well adopt a similar project for material of state-wide interest."

Dr. Buie suggests that any member having such historical information and desiring to file it with the Society should contact him at 1401 Hampton Street, Columbia, South Carolina, or write the national office. He further states that material should not be sent until it has been determined if it would be a valuable addition to the archives.

Help to Foreign Visitors

Between January 1 and July 1 the Soil Conservation Service assisted 269 foreign administrative and technical visitors study soil and water conservation in continental United States, Puerto Rico and Hawaii.

Excerpts from Letters to the Executive Secretary

Dear Wayne:

Extracts of Dr. Gustavson's paper have been sent with a personal letter to the editors of all daily papers in South Carolina and also to all members of Congress from [the State]. In addition a copy of Mr. Rozzoni's paper has been sent to [the president] of the S. C. Farm Bureau Federation.

We could not pass up the opportunity to utilize further some of the important facts presented at the excellent [Asilomar] meeting.

We are determined to make the 1958 meeting at Asheville equally successful.

September 16, 1957.

T. S. Buie,
State Conservationist,
Soil Conservation Service,
Columbia, South Carolina.

Dear Mr. Pritchard:

Let me again congratulate you and the other officers for arranging such an outstanding program for the annual meeting at Asilomar.

My interest and that of the Board of Water Commissioners was high when we learned that the theme of the meeting would be "Water." I was not disappointed to find that throughout the meeting this great resource was given its rightful place —at the top with top authorities handling the job of presenting papers of every phase of water.

September 16, 1957.

C. W. Steadman,
Agricultural Engineer,
Mississippi Board of
Water Commissioners,
Jackson, Mississippi.

Secretary's Column

THE NATIONAL COUNCIL of the *Society* met in the patio office of the California State Division of Forestry in Monterey just prior to the national convention. Lew Moran, Deputy Director of the Division, was host to the council. All council members and officers except Walter C. Gumbel and Chester Wilson, who had conflicting schedules were in attendance.

Arrangements for the three day council session were made by H. A. Hopper, Western Region Council member. His secretary, Mrs. June Del Buano, was on hand to assist the council and Leonard Marr, soil conservation engineer of Watsonville, California, recorded the council transactions.

On the final day of the council meeting, August 28, the council members were guests of the California State Soil Conservation Committee at a luncheon session.

Several committee chairmen appeared before the council to present reports while others mailed their reports to the secretary.

Howard F. Barrows, national treasurer, reported the *Society* had a cash balance in the operating account, on July 31, 1957, of $17,834.10 as compared to $11,101.46 on the same date in 1956. He stated the *Society* would operate "in the black" for 1957 unless additional funds were invested in an inventory of booklets. Barrows also reported the net worth of the organization to be $43,833.93 on July 31 as compared to $35,359.59 on July 31, 1956. The *Society* has $15,000 invested in government savings bonds and now has office equipment valued at $3,646.70. He stated that deposits of $31,135.54 had been made from sale of the booklet **Story of Land** between May 1955 and August 1957—that booklet sales had contributed materially to the finances of the *Society*.

The council studied the membership reports distributed by the secretary and noted an increase of 8.8 per cent since the Tulsa convention. (This has increased since the California meeting. The total membership was reported in the September JOURNAL.)

President Russell called on each council member for a report and there was considerable agreement that the steps taken in 1954 to provide regional representation on the council had resulted in increased interest in several areas of the country.

Harper Simms, chairman of the special publications committee reported more than 6,000 copies of the publication **Our Watershed Resource** had been sold, while 104,000 copies of **The Story of Land** had been sold during 1957 bringing its total to more than 800,000. He also reported that a new four-color booklet **The Wonder of Water** would be ready late in the year.

The council voted to give consideration to appropriate publications in the professional field of soil and water conservation.

The editor selection committee formally announced the appointment of Douglas E. Wade as editor of the JOURNAL OF SOIL AND WATER CONSERVATION effective September 15, 1957.

Ross Davies, chairman of the chapter activity committee described the growth and development of chapter activities emphasizing the entry of 19 chapters in the first chapter contest. It was recommended the program be continued for another year.

The council also approved the proposal to adopt a membership certificate. It will be made available through chapters.

During 1957 President Russell had a committee at work headed by R. G. Hill, vice president, studying the future of the *Society*. Here are some of the committee's considerations:

1. **Regional meetings as compared to annual meetings**
2. **Revision of the by-laws to allow establishment of a development fund**
3. **The *Society's* publishing program**
4. **The problem of making the *Journal* more attractive to broader *Society* interest**
5. **The immediate establishment of the *Society's* entire awards program**
6. **Strengthen the *Society's* program of public relations for soil conservation**
7. **Ways and means the *Society* could establish opinions on public policy as related to conservation and be in a position to serve the movement and represent the broad membership**
8. **The possibility of establishing a book purchasing service for members**
9. **Ways to strengthen the *Society's* effort in the promotion of soil conservation throughout other portions of the world.**

It was the decision of the council to continue national annual meetings but to give consideration to regional meetings at some future date.

A series of future booklets were outlined —to include one on theme of "America The Beautiful," another on land use and trees. It was also proposed that a publication on diversion of agricultural land be considered.

With an increased program for 1958 the council adopted a budget based on a membership of 8,000 and an income of $86,375. The same budget calls for expenditures of $79,705. This is the largest budget the *Society* has had in any year.

—H. WAYNE PRITCHARD
Executive Secretary

Water: Too Little, Too Much

"TO LEARN more about water" was the theme of the 12th annual SCSA convention held in California.

("Pictorial" on next page is dedicated to the behind-the-scenes convention workers.)

1. Inner man must be satisfied; lines form near Crocker Hall at mealtime. The staff at Asilomar State Park performed ably.

2. One could wrap around those steaks —and did. California Spray-Chemical Company was host, assisted by "chefs" of Monterey county soil conservation district.

3. Is this another meal, or some entertainment? Some more hosts: Fullerform, Inc.; Ferry-Morse Seed Co.; Spreckles Sugar Co.; Marvin Landplane Co.; Sun Packing Co.; Armco; Monterey Peninsula Visitor and Convention Bureau; and Farmland Irrigation Co.

4. Three honorary members: *l-r*, D. L. Strathearn, Howard Miller and N. R. Crowe.

5. Nolan Fuqua spoke on "A coordinated watershed approach to soil and water problems."

6. E. L. Peterson, assistant secretary of Agriculture, probed into "The problem of water for the future."

7. "Streamlining research to fit expanding water demands" was O. J. Kelley's assignment.

8. President J. S. Russell performed graciously in introducing the officers for 1958.

9. Marvin Anderson of Iowa State College challenged all of us in "Improving public understanding of water problems."

10. Louis Rozzoni and Charles Butler raise toast of Asilomar *water* to "theme."

11. Ably presiding at the Friday evening session is Don Williams.

12. R. G. Hill and William Fischer receive the national first-place chapter activities' contest award-certificate won by Michigan.

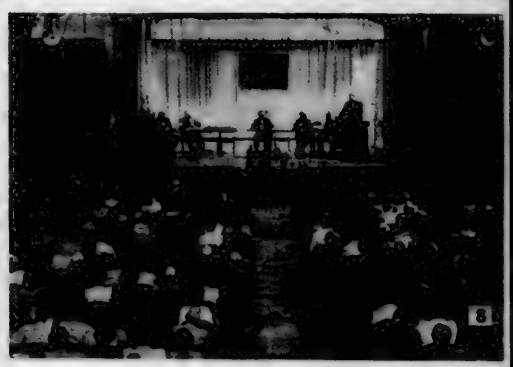
13. Council members of 1957 and 1958, *bottom row, l-r*, A. H. Veazey, R. G. Hill, J. S. Russell, H. W. Pritchard, H. F. Barrows; *top row, l-r*, M. Silliman, A. C. Watson, H. A. Hopper, F. E. Bear, E. L. Sauer, H. C. Bobst. (Absent are: J. W. Barnard, H. M. Chambers, E. H. Graham, W. C. Gumbel, J. K. Vessey and C. S. Wilson.)

14. North Carolina chapter, winner of southeast region contest, receives a fitting certificate. George Winchester and C. L. Hunt doing the honors.

15. One's conscience did not permit loitering on this passage. California products, including a wine-testing, was a delightful interlude to work sessions.

16. Asheville, North Carolina, in 1958 and Rapid City, South Dakota, in 1959.

17. Thanks to Herb Boddy's publicity committee and Frank M. Roadman, photographer. If you didn't spot yourself, look at the chef in the lower right corner: "Half a loaf is better than none."



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HISTORY

CHAPTER NEWS

Excellent Meeting Held

Oklahoma Council of SCSA Chapters met September 27 and 28 in Oklahoma City, with 190 in attendance.

Water was the theme of this first annual meeting. No major aspect of water in Oklahoma was neglected by the speakers and panels.

Apparently, Herschel Burrus, Edd Roberts and Mrs. Mary Hutchings, along with other hard-working committee members, did not forget any details of a smooth-running program.

According to a first-hand report from Wayne Pritchard, national executive officer of the SCSA, the Oklahoma state meet was one of the best of its kind he has attended. Wayne gave one of the major talks at the banquet, describing progress in the *Society*.

Hon. Carl Albert, member of Congress, Washington, D. C., spoke at the banquet on the topic, "Oklahoma's Water—Opportunities and Problems."

Following a lively panel discussion on chapter matters, C. E. Kingery, secretary of the state council, delivered a hard-hitting talk on "Working Chapters."

In all, 33 persons were scheduled on program parts of the two-day meeting.

George H. C. Green, Oklahoma Bankers Association, presided as toastmaster. Entertainment was furnished by the Oklahoma City University music department.

A special program was listed for the ladies.

Front-page reportings of the talks were given in local papers.

Two papers have been submitted to the JOURNAL for review and possible publication.

Several local and state industrial and commercial concerns played hosts at social hours and sponsored printing of the program.

Congratulations to the Oklahoma Council and chairman, Harry M. Chambers, for this pace-setting annual meeting.

Florida Chapter is holding a number of subchapter meetings with each councilman acting as host. This spreads meetings around the state with more frequency and greater ease of travel. All-chapter membership meetings will continue. Chapter dues were raised to $2.

Hoosier Chapter believes in combining meetings with tours. July meeting and tour included the Willow Slough State Game Area. In October members will visit the Southern Indiana Forage Farm.

The chapter issues a lively newsletter.

West Tennessee Chapter used a printed ballot and covering letter this fall in electing officers. The letter also served in announcing a meeting date and inviting all SCSA members in the area to join the chapter.

Miss Shirley Ann Dowdy, RFD, Mayfield, Kentucky was mildly surprised when she looked behind the curtain of this booth. The booth was the idea and work of the Kentucky Lake Chapter, and is described below.

Kentucky Lake Chapter of Kentucky built a display booth for use at fairs and other meetings.

The exhibit, described by Wayne Williams, cost $31. It has a moving Fire Prevention segment to the left, and on the right is a hole for viewing slides projected automatically. Included on the booth is a booklet distribution space.

The exhibit and work of the chapter and the national parent SCSA have received excellent newspaper publicity. In August and September the exhibit was set up at three fairs and one college.

Inland Empire Chapter of the state of Washington is giving real assistance to the new **Olympic View Chapter.** From all indications of past activities of Inland, the Olympic View Chapter will be getting some fine hints on how to make a chapter work.

Inland had a neat exhibit at the national convention. Good stories were told, using eight- by 10-inch colored pictures of farm and ranch conservation plans.

Michigan Chapter October meeting included two papers on radiation and application of atomic energy to agriculture and related fields.

A reactor and other installations were viewed at the Cooley Memorial Laboratory on the university campus.

Metropolitan growth and land use was the topic of a dinner address by Richard L. Meier, research associate of the Mental Health Institute of the University.

In the evening session, Russell G. Hill moderated a panel on the functions of planning with emphasis given to county planning, watershed approach and industrial resources.

The Future Farmers of America soil and water conservation project sparked by the Michigan Chapter enters its fifth year, according to W. S. Harrison, chapter secretary.

Sponsors will be the Farm Bureau and affiliated companies, Michigan association of F.F.A. and the Michigan Chapter of the SCSA.

About one-third of the state F.F.A. chapters have participated each year.

Utah Chapter Sponsors Tourama

Report Submitted by LOWELL J. FARMER

FOR THE UTAH CHAPTER July 12 marked an outstandingly successful **Tourama** studying various aspects of the American Fork watershed, stated Lowell J. Farmer, U. S. Forest Service, and chairman of the field trip.

Tourama brought together representatives from the universities of Utah and Brigham Young, industry, state wildlife, Forest Service, SCS, National Park Service, county and municipal governments, Soil Conservation Districts and several watersheds.

With 90 present, a start was made in Utah Valley overlooking Utah Lake, the Geneva Steel plant and far-reaching irrigated fields and orchards. There Mayor Frank Sharp of Lehi briefed the group, while others pointed out lowland drainage problems.

Dutch oven filets and steaming "sheepherder" coffee, along with refreshments by the Utah Concrete Company, rounded out the watershed tourama.

SCSA chapter members on planning committee included Ralph Felker and John Bradshaw, SCS, and Jerry Hill and Henry Lobenstein, Forest Service.

Tibble Fork stop. Robert Bridges of SCS relates geology to proposed water storage area. At Timpanogas Cave National Monument recreational aspects of a small watershed were not neglected.

Dr. Walter P. Cottam eminent University of Utah botanist reviews how grasses and other perennial plants reduce soil erosion.

Influences of plants to water infiltration are sketched in by Lewis Clark, Forest Service. Harry Woodward, SCS, estimates capitalized multiple-use worth of watershed at $250 per acre.

Local farmer Leo Harvey saves water with concrete ditches and other modern methods. Results: 7½ tons of alfalfa per acre. Any excess over 2-acre feet of water would have been wasted.

At Granite Flat overlook, Clarence Thornock, Supervisor of Uinta National Forest, told of plans for water and soil conservation in the upper reaches of watershed. Included were contour trench terraces, grass seeding and reduction in grazing.

Left to right, D. Joseph Sacco, Mrs. Henry H. Hackman, Hackman, and David G. Unger. At 11th annual meeting of the Keystone chapter, Sacco (Conservation Awards Committee) and Unger (Advisor to Soil Conservation Districts) present citation to Hackman as Pennsylvania's outstanding conservationist.

Keystone Chapter of Pennsylvania held its 11th annual meeting in August at Pennsylvania State University.

A well-rounded program was held with speakers representing agriculture, education, engineering, agronomy, economics and sociology.

Included in the two-day meeting was a business meeting and a visit to the Garfield Thomas Memorial Water Tunnel. [The JOURNAL needs a story on this tunnel.]

New Jersey Chapter fall meeting featured field trips to the Tuckahoe Game Preserve and Belleplain State Forest in south Jersey.

A seafood dinner fittingly topped off a rigorous day in the field.

North Carolina Chapter made some tape-recordings during the SCSA conventions at Asilomar. By October 1 the tapes had been used at Ashville, Greensboro and scheduled for some Raleigh, North Carolina, broadcasts.

J. R. Sasser of Nashville, Tennessee, joined in with making of the tapes.

Northern Illinois Chapter executive committee meeting held in August included reports on student activities committee and land improvement committee.

Through a four-man panel presenting four phases of soil and water conservation, it was expected that student branch meetings would benefit.

The land improvement committee is working on some leads for "live" projects (demonstrations) on stripmine lands and state parks. [Have any other chapters engaged in similar projects? If so, reports could be submitted along with photographs for possible use in the JOURNAL.]

The **Old-Line** and **Pocomoke Chapters** of Maryland, with **Chapter No. 1** of Washington, D. C., held their annual joint outing at Ocean City, Maryland.

Mrs. Frances H. Howard, director, Maryland United Nations Association, spoke on the "Specialized Agencies — Life-Line of United Nations."

World population, resources and resource needs were stressed in this talk.

Show-Me Chapter of Missouri continues its excellent newsletter, carrying items on members and progress on land and water projects throughout the state.

The August 28, 1957, Newsletter contains a brief on a 1½-acre "dream" pond with a 15-acre watershed.

"The pond was built in June, 1955, and, in spite of 72 inches of rainfall since then, has never been full.

"The watershed consists of many small patches or trial plots of native and exotic grasses. Area is mowed once or twice each year. The resulting mulch and sod yields very little runoff.

"During the past two years we have had 23 rains of an inch or more at a time—nine of them exceeding 1½ inches. Even the 20.26 inches we had in April, May and June of 1957 failed to fill the pond.

"With watershed protected with this kind of cover, think how small the draw-down pipes could be in flood detention reservoirs!"

West Virginia Chapter news was sent in by John Grant, publicity chairman. (His report, double-spaced, required little editing.)

Meeting at Jackson's Mill, September 26-28, 100 members enjoyed an illustrated talk by Lloyd Harrold of the Agricultural Research Service at Coshocton, Ohio.

Showing slides and a hydraulic water flow machine, Harrold demonstrated the handling of the energy in water with the most efficiency and safety.

By using minimum tillage, the speaker also pointed to good results from plowing and planting corn at the same time. Yields were high, costs were cut and soil moisture losses were reduced.

Use of plastic coverings over plants in fields to prevent evaporation was shown.

Banquet speaker, L. L. Males of Cheyenne, Oklahoma, illustrated "The Watershed Approach to Flood Prevention," and David Unger of Harrisburg, Pennsylvania, showed films on "Teamwork in Conservation."

The chapter recommended formation of a state-level conservation education council to implement the work of the Department of Education. The department recently published a noteworthy handbook entitled, *Living, Loving and Learning West Virginia.*

Other talks were given on water rights, farm fish pond management, pasture management and wildlife resources.

Virginia Chapter gave its ninth annual meeting good coverage in mimeographed "minutes" sent to all members.

"How to advance the science and art of good land use" proved stimulating for a five-man panel. The panel concluded that (1) professional conservationists must be personal ambassadors to promote soil and water conservation; (2) we must be alert to grasp every opportunity to advance our program; and (3) the public must be kept informed.

To meet these goals, it was suggested that the chapter serve as a *quorum* for projects such as: (1) using local speakers to aid in public relations; (2) assisting in school projects through field trips and furnishing materials; (3) helping to provide conservation education scholarships to teachers; and (4) cooperating with the State Department of Education in getting conservation into the curriculum.

In reporting on the Asilomar convention, J. H. Sheppe pointed out how a conservation education committee in the West Virginia Chapter has been effective, particularly in assisting agencies and organizations work together on a state-level conservation education program.

The Virginia meeting was enriched by slide talks on conservation in the Orient, Korea and the Middle East.

The regional USDA forester, T. H. Fearnow, spoke on "Know Your Watershed."

The urgency of giving every teacher opportunity to learn fully the facts about conservation was pointed out by Mrs. H. E. Adams, school teacher at Covington, Virginia.

The meeting closed on the note that at least 100 SCSA members from Virginia ought to be present at Asheville for the 1958 national convention.

Wyoming Chapter held its first meeting, September 20 and 21. One day included a field trip to observe forest and wildlife management activities in the Pinedale section in western Wyoming.

Range reseeding, as well as sagebrush spraying, has resulted in excellent forage production and increase in native grasses.

Use of fences in elk management and winter-feeding of elk and multiple use of forest lands for recreation, grazing, timber cutting and watershed protection were among the topics included.

Timber harvest of beetle-damaged spruce was also shown and discussed in the field.

Talks and panels on forestry and wildlife management in western Wyoming rounded out the two-day meeting.

Good newspaper publicity was given to the meeting which was attended by 50 members. An excellent start for this new chapter.

NEWS OF MEMBERS

P. H. Montgomery, State Soil Scientist in South Carolina, has been appointed Assistant Director, Soil Survey Interpretations, S.C.S., Washington, D. C.

M. D. Atkins, Manhattan, Kansas, formerly Field Plant Materials Technician, S.C.S., for Kansas and Oklahoma, has succeeded **H. W. Cooper**, Lincoln, Nebraska, as Washington Field Plant Materials Technician for the Great Plains. Mr. Cooper has gone to Bozeman, Montana as Deputy State Conservationist.

Bon D. Grussing has been appointed director of merchandising for the Brown & Bigelow special sales division, St. Paul, Minnesota.

C. W. (Chet) Cleary, Jr., has been named state conservationist for Nevada.

Assistant Administrator of S.C.S., **W. R. Van Dersal**, who is on a year's leave studying under a Rockefeller grant, has returned from his round-the-world trip that took him to Australia, New Zealand, England and Scotland, where he studied the administration of natural resources in those countries.

The Department of Agriculture's Superior Service Award for outstanding training given in woodland conservation was given to **Carrow T. Prout, Jr.,** of Mobile, Alabama.

Charles Harper, vice-president of the South Alabama Chapter, Monroeville, received a letter of commendation and cash award from the State Conservationist, also a Certificate of Merit for his "high production of quality soil and water conservation work and effective working relations with community and other groups."

Luther E. Gowder, Eutaw, Alabama, received a similar award and a Certificate of Merit for "outstanding production of high quality work."

A. C. Watson, who has been head of the administrative services division for S.C.S., now becomes Interagency River Basin representative for that agency in the Northeast.

O. R. McMurry, for the past six years executive secretary of the Iowa State Soil Conservation Committee, has been appointed Director of the Iowa Natural Resources Council.

Richard K. Bullard, Des Moines, Iowa, has been appointed state water commissioner. This is a new position created by the last session of the legislature and is under the Iowa Natural Resources Council.

William Greiner, Des Moines, has been appointed executive secretary of the Iowa State Soil Conservation Committee.

Martin Ekovich, formerly of Hillsboro, Illinois, is now assistant state conservationist in Illinois.

South Dakota members **A. L. Ford** and **Louis Eberlein** were recently presented U.S.D.A. thirty year service awards. Twenty year certificates went to **C. O. Brown, C. A. Treadwell, Harry Eaton, Vernon Moxon, S. W. Wikle, J. Shyne** and **B. Davidson**.

Mack McConnell, Houston, Texas, has received a 30 year certificate for service with U.S.D.A., S.C.S.

A superior service award was presented by Secretary Benson to member **Homer A. Taff,** assistant state conservationist, Temple, Texas, for his work in the Great Plains of that state.

Kenneth K. Neitzel, Soil Conservation Service, who has been an active member and served as secretary for the Wisconsin Chapter of the *Soil Conservation Society of America*, has transferred from Madison, Wisconsin to Washington, D. C. He will become a member of the Internal Audit staff of the Washington office of S.C.S.

Robert K. Lawson has accepted the position of management agronomist for S.C.S. in Illinois.

Ben F. Muirheid, formerly agricultural engineer in soil conservation for Illinois Extension Service, has accepted a position as advisor in soil conservation to the Government of India.

Milfred Richman, work unit conservationist, Albion, Indiana, received a Superior Service Award from USDA for his work in Noble County, Indiana.

Frank Edminster is transferring position as State Conservationist for New Jersey to State Conservationist for Virginia.

Hubbard Gayle, state conservationist for S.C.S. in Lexington, Kentucky, has retired. **Herschel Hecker**, also of Lexington, is the new state conservationist.

Robert S. Calkins, charter member of the *Society,* has been named Materials Engineer in the Soil Mechanics Laboratory at Lincoln, Nebraska. He will work with interpretation of laboratory data as it pertains to design and construction activities of S.C.S.

Dr. W. H. Garman will continue to serve the **National Plant Food Institute** as its chief agronomic consultant in addition to heading up the institute's expanded program of research and education in the Northeastern states. He will be located at the institute's offices at 1700 K Street N.W., Washington 6, D. C.

George E. Huey and **Philip K. Cornelison** of the DeKalb (Alabama) SCS work unit and members of the North Alabama Chapter of the SCSA received certificates of merit, letters of commendation and cash awards for "quality soil and water conservation work."

Stanley F. Cosby, deputy California state conservationist, is in Morocco for a six weeks' International Cooperation Administration assignment to confer on irrigation problems.

Luis Rivera, Oswego (New York) soils man from Puerto Rico, received a certificate of merit and cash award for accomplishments in his work unit.

Dave Gardner really earned his Ph.D. His thesis, "The National Cooperative Soil Survey in the United States," is 426 pages of double-spaced typewriting. [Notices and abstracts of theses are welcomed for inclusion in the JOURNAL.]

D. W. Pittman, formerly Professor of Soils and Agronomy at Utah State Agricultural College, has retired to care for a small avocado grove at 1901 Alessandro Trail, Vista, California.

THE WONDER OF WATER
New Society Booklet now Available

WONDER OF WATER

MIDVALE was a prosperous small community in America until drouth brought a shortage of water during a recent summer.

The episode continues: farm crops were severely damaged and business activities fell off, bringing near-panic to the citizens of Midvale.

Here is the beginning of the story depicted by the *Society's* new booklet **Wonder of Water**, a 16-page, 4-color, cartoon-style presentation, to be released for bulk distribution about December 1, 1957. (See advertisement on page 258 of this issue of the JOURNAL.)

The story continues by showing how the city fathers first decided to build a pipeline to bring water to the community, but when the pipeline was nearly completed a flood washed away the project.

At this point there was a general knitting together of thoughts: the entire watershed covering the area must be treated. Opinion and action were jelled by the city council, the high-school student and adult leaders, the local soil conservation district and others.

These dramatic events end with the completion of a successful community project which brought benefits to all in the watershed. The land was stabilized and more water was made available to agriculture, industry, wildlife, recreation and the community.

While Midvale is mythical, **Wonder of Water** presents a realistic story—one that has been re-enacted many times in America during recent severe drouth years.

Harper Simms, chairman of the *Society's* special publications committee, and its other members are to be complimented for their work on this new booklet.

Single copies of **Wonder of Water** will be mailed to each *Society* member, to each soil conservation district and to other conservation organizations as soon as possible.

Art work, layout and printing were done by the Wm. C. Popper Company of New York.

Wonder of Water will be handled in a way similar to that for the *Society's* first cartoon-type booklet, ***The Story of Land***, which has had a run of nearly a million copies, having been distributed by local business firms, banks, industries, districts and others.

Wonder of Water is the better-prepared publication of the two booklets, but the two make a real "team" to be used throughout America in telling the story of soil and water in their relation to community development.

News of Members

Dr. Harold G. Wilm, member of the SCSA since 1952 and associate dean of the college of forestry at Syracuse University, Syracuse, New York, was elected president of the **International Association of Scientific Hydrology**. He will serve for three years.

The IASH is concerned with the movement of water over and within the earth—from its precipitation as rain or snow until it reaches the ocean. The association's membership is composed, almost exclusively, of physical scientists and engineers.

A current objective of IASH will be to make an international analysis of the influence of forests and forest management on water yields and erosion.

"With intensifying demands for water and widespread shortages," stated Dr. Wilm, "the protection and proper management of watershed forests is becoming increasingly important today in many places of the world."

John M. Cross, president of the North Alabama Chapter of the SCSA, received similar awards for assisting land owners in planning and applying engineering conservation practices in the Marshall (Alabama) work unit.

R. M. Marshall, formerly with the SCS in Texas, has been assigned to the Washington office as an assistant director, Soil Survey Operations.

Marion W. Sullivan, SCS soil scientist stationed at Sumter, South Carolina, served as instructor for a third consecutive season at the annual **South Carolina** (youth) **Conservation Camp.**

In three seasons (camp runs one week each season) more than 300 high school boys and girls and a number of teachers have been exposed to the inter-relationships of natural resources.

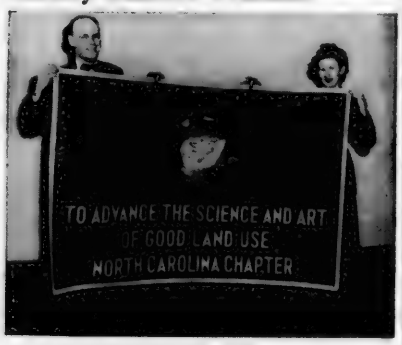
Mack McConnell of Houston, Texas, was recently presented a USDA 30-year service certificate and emblem.

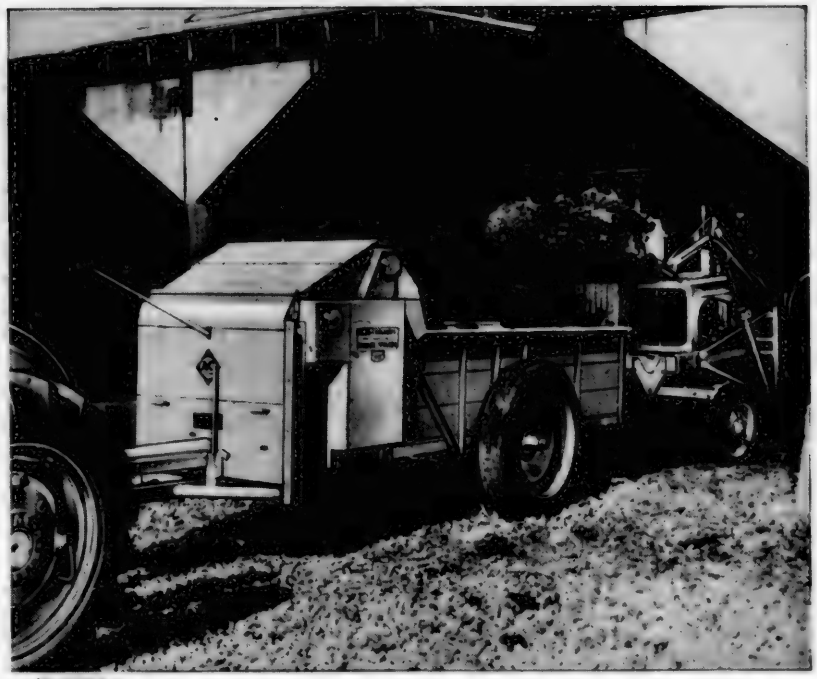
Don A. Williams, administrator, SCS, Washington, D. C., is author of "Our Farmlands Are Shrinking," May, 1957, **Coronet.**

The gist is in this short quote: "Science really has its work cut out for it to feed the additional population in 1975—without even trying to make up for the additional 27,000,000 acres of prime farmland which we estimate will be taken away from food production in the next 19 years. . . ."

W. J. Lloyd of state of Washington, and **C. T. Trout, Jr.**, of Alabama, are the two SCS woodland specialists slated to attend Harvard University's fifth conference on forest production, October 6-18.

Society Banners Available





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Engineering in Action

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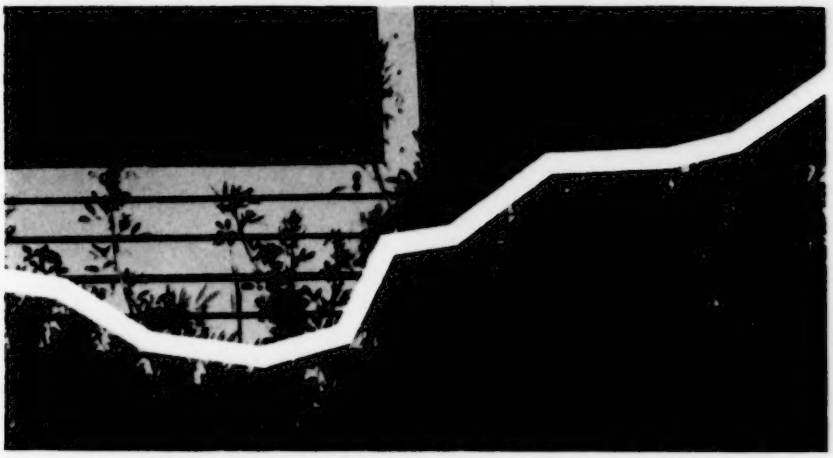

In a Washington State test, sweet clover responds to moly fertilization with yield of 1.5 tons of hay per acre (area at right). Control area (left) yielded only 0.7 ton per acre.

(Photo courtesy State College of Washington).

Average yield or high production? Moly may make the difference

Moly can give striking increases in yields, even on land farmers thought was "good enough"

During the past few years agronomists and many farmers have witnessed the dramatic upturn of crop yields when small additions of molybdenum were made to moly-starved soils. These results have been widely reported, and today the more obvious symptoms of moly-starvation are quickly recognized by most county agents.

But how about the much larger areas where moly-deficient soils might be described as undernourished rather than starved? Here moly can make the difference between average yields, average quality, average profits and high yields of premium quality crops that mean extra income.

At the present time these areas of potential response to moly treatment are known to include large parts of the eastern U.S. and much of the arable land of the Pacific Northwest. They take in many productive farms whose owners, lacking a standard of comparison, are reasonably satisfied with present yields.

In these areas, tests by experimental stations and growers alike have established that moly applications can boost yields by 12 to 93%. Although such improvements are not perhaps as spectacular as in moly-starved soils, they have already added to the profits of individual farmers. Broad-scale treatment of these undernourished soils can contribute substantially to overall farm production.

How Moly Works

A fact that has emerged from many studies of micronutrients is that moly is essential to nitrogen fixation. Legumes require moly for the fixation of atmospheric nitrogen by the bacteria in their root nodules. All crops need it to reduce nitrates to nitrogen—the first step in protein synthesis.

When there isn't enough available moly in the soil to satisfy plant requirements, crops literally starve to death (as in the case of serious, visible deficiencies), or achieve only a fraction of their potential growth (as in the case of many fields with "normal" productivity).

On the other hand, small amounts of moly have given both substantial increases in crop yields and marked improvement in quality to many farmers who were once content with fair to average production. In many cases alfalfa has a higher protein content when "normal" fields are treated with moly. Cauliflower runs to large size, more succulent flavor.

Consider the effect of moly on a typical few of the 30-odd crops for which responses have been reported:

Alfalfa—In field tests in New Jersey, Dr. Harold J. Evans of Rutgers University obtained an average increase in yield of 13%, marked improvement in protein content. In field tests in Spokane County, Washington, Dr. H. M. Reisenauer of the State College of Washington found that treating molybdenum deficient fields with moly increased yields an average of 40%.

Melons—A Virginia grower reports that with moly treatment he gets an average of 7 runners per vine with each runner bearing a large melon. Untreated plants bear fewer runners, much smaller fruit.

Peas—In eastern Washington and northern Idaho, where both dry edible and seed peas are a major crop, commercial use of moly is producing more peas per pod, more pods per vine. And vines are longer, easier to harvest. Yield increases in commercial tests have averaged 63%. Many farmers realize a return of $10 on each dollar invested in moly.

Cauliflower and Lettuce—Growers on Long Island and in upstate New York, in Rhode Island and mid-New Jersey report more vigorous cauliflower plants with heads of better quality. Color and leaf structure of lettuce improved. Yields were consistently higher than for untreated fields.

Testing is Easy

Although crops vary in their moly requirements and responses vary with soils, there is one sure way for a grower to find out whether he can increase the yield and quality of a particular crop on a particular soil: run a field test. It's easy to do.

A stock solution for such tests is made by dissolving one ounce of sodium molybdate in one gallon of water. For vegetable crops, select and mark one or more rows through the center of the field. Mix three cups of the stock solution with one gallon of water and apply to the test rows, using about a quart to a 250-foot row. Compare the test rows with untreated rows every other day. Check yields and quality against untreated areas at harvest.

For legumes, lay out a test plot 10 yards square in a location that will make it easy to compare with untreated soil. Follow the usual fertilizer plan, but do not use nitrogen on either the test plot or the control areas. Spray the test plot with three cups of stock moly solution to a gallon of water. This may be done at the time of seeding, or to an established stand. Because increases of 25% or less are difficult to evaluate visually, clipping tests should be made.

For detailed information on the handling of moly test plots write Climax Molybdenum Company, Dep't. 50, 500 Fifth Avenue, New York 36, N. Y.

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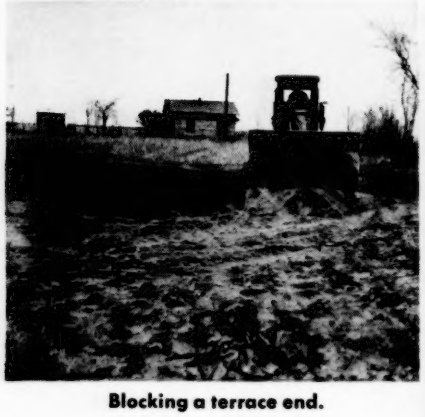

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